UNIVERSITY OF ALBERTA

# DEVELOPMENT OF A DISEASE-SPECIFIC HEALTH-RELATED QUALITY OF LIFE INSTRUMENT FOR PEOPLE WITH CYSTIC FIBROSIS

BY

MELINDA A. CONNOLLY

A THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH

IN

HEALTH POLICY RESEARCH

DEPARTMENT OF PUBLIC HEALTH SCIENCES

EDMONTON, ALBERTA

SPRING 2000

National Library of Canada
Acquisitions and Bibliographic Services
395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale du Canada
Acquisitions et services bibliographiques
395, rue Wellington
Ottawa ON K1A 0N4
Canada

*Your file Votre référence*

*Our file Notre référence*

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-60085-8

Canada

**UNIVERSITY OF ALBERTA**

**LIBRARY RELEASE FORM**

**NAME OF AUTHOR**: MELINDA A. CONNOLLY

**TITLE OF THESIS**: DEVELOPMENT OF A DISEASE-SPECIFIC HEALTH-RELATED QUALITY OF LIFE INSTRUMENT FOR PEOPLE WITH CYSTIC FIBROSIS

**DEGREE**: MASTER OF PUBLIC HEALTH

**YEAR THIS DEGREE GRANTED**: 2000

PERMISSION IS HEREBY GRANTED TO THE UNIVERSITY OF ALBERTA LIBRARY TO REPRODUCE SINGLE COPIES OF THIS THESIS AND TO LEND OR SELL SUCH COPIES FOR PRIVATE, SCHOLARLY, OR SCIENTIFIC RESEARCH PRUPOSES ONLY.

THE AUTHOR RESERVES ALL OTHER PUBLICATION AND OTHER RIGHTS IN ASSOCIATION WITH THE COPYRIGHT IN THE THESIS, AND EXCEPT AS HERINBEFORE PROVIDED, NEIGHER THE THESIS NOR ANY SUBSTANTIAL PORTOIN THEREOF MAY BE PRINTED OR OTHERWISE REPRODUCED IN ANY MATERIAL FORM WHATEVER WITHOUT THE AUTHOR'S PRIOR WRITTEN PERMISSION.

Melinda Connolly

#4, 81 SOMERSET WEST
OTTAWA, ON, K2P 0H3

DATE: January 27, 2000

**UNIVERSITY OF ALBERTA**

**FACULTY OF GRADUATE STUDIES AND RESEARCH**

THE UNDERSIGNED CERTIFY THAT THEY HAVE READ, AND RECOMMEND TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH FOR ACCEPTANCE, A THESIS ENTITLED **'DEVELOPMENT OF A DISEASE-SPECIFIC HEALTH-RELATED QUALITY OF LIFE INSTRUMENT FOR PEOPLE WITH CYSTIC FIBROSIS'** SUBMITTED BY **MELINDA A. CONNOLLY** IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN HEALTH POLICY RESEARCH.

Dr. Philip Jacobs

Dr. Jeffrey Johnson

Dr. Neil Brown

Dr. Peter Calder

Date: Jan 25/2000

**ABSTRACT**

The literature on health-related quality of life (HRQOL) highlighted the lack of available instruments specific to cystic fibrosis (CF). The objective of this study was to develop a disease-specific HRQOL instrument for people with CF.

Two versions of a disease-specific HRQOL instrument were developed for people with CF: the ACFQ for adults and the TCFQ for adolescents. Both instruments have ten domains: general health, physical function, respiratory symptoms, GI symptoms, pain symptoms, treatment burden, social role, worry about body image and awareness, worry about social interactions, and emotions.

Preliminary evidence of the validity and internal consistency reliability in a discriminative (cross-sectional) analysis was evaluated. Reasonable measurement properties for the general health and respiratory symptoms dimensions were demonstrated to exist, while additional refinement and testing is required for the other scales.

## TABLE OF CONTENTS


| | | PAGE |
|---|---|---|
| I. | INTRODUCTION | 1 |
| II. | BACKGROUND | 3 |
| | 1. HEALTH-RELATED QUALITY OF LIFE (HRQOL) | 3 |
| | 2. INSTRUMENT DEVELOPMENT | 5 |
| | 3. PSYCHOMETRIC PROPERTIES | 8 |
| | 4. CYSTIC FIBROSIS | 10 |
| | 5. CLINICAL OUTCOME MEASURES IN CF | 11 |
| | 6. GENERIC HRQOL IN CF | 14 |
| | 7. CF-SPECIFIC HRQOL | 25 |
| | 8. SUMMARY | 27 |
| III. | METHODS | 28 |
| | 1. INSTRUMENT DEVELOPMENT | 28 |
| | 2. CLINICAL TESTING – MEASUREMENT PROPERTIES | 32 |
| IV. | RESULTS – CLINICAL TESTING | 40 |
| | 1. PATIENT DESCRIPTION | 40 |
| | 2. HRQOL DESCRIPTION | 40 |
| | 3. CLINICAL DESCRIPTION | 46 |
| | 4. RELIABILITY | 48 |
| | 5. VALIDITY | 50 |
| V. | DISCUSSION | 60 |
| | REFERENCES | 65 |
| | APPENDICES | 72 |

## LIST OF TABLES


| | | PAGE |
|---|---|---|
| Table 3.1 | Hypothesized Correlations Between ACFQ/TCFQ Scores and Clinical Variables | 36 |
| Table 3.2 | Hypothesized Correlations Between ACFQ/TCFQ Scores and SF-12 / EQ-5D Scores | 38 |
| Table 4.1 | Demographic Statistics | 40 |
| Table 4.2 | ACFQ Statistics | 41 |
| Table 4.3 | ACFQ Inter-scale Correlation Coefficients | 42 |
| Table 4.4 | TCFQ Statistics | 43 |
| Table 4.5 | TCFQ Inter-scale Correlation Coefficients | 43 |
| Table 4.6 | Adult EQ-5D Scores | 44 |
| Table 4.7 | Teen EQ-5D Scores | 45 |
| Table 4.8 | SF-12 Scores | 46 |
| Table 4.9 | Adult Clinical Statistics (Continuous Variables) | 46 |
| Table 4.10 | Adult Clinical Statistics (Categorical Variables) | 47 |
| Table 4.11 | Teen Clinical Statistics (Continuous Variables) | 47 |
| Table 4.12 | Teen Clinical Statistics (Categorical Variables) | 48 |
| Table 4.13 | ACFQ Domain Alpha Scores | 49 |
| Table 4.14 | TCFQ Domain Alpha Scores | 49 |
| Table 4.15 | Correlations Between ACFQ Scores and Demographic Variables | 50 |
| Table 4.16 | Correlations Between ACFQ Scores and Clinical Variables | 51 |
| Table 4.17 | Correlations Between TCFQ Scores and Demographic | |

| | | |
|---|---|---|
| | Variables | 51 |
| Table 4.18 | Correlations Between TCFQ Scores and Clinical Variables | 52 |
| Table 4.19 | Correlations Between ACFQ Scores and EQ-5D Scores | 53 |
| Table 4.20 | Correlations Between TCFQ Scores and EQ-5D Scores | 53 |
| Table 4.21 | Correlations Between ACFQ/TCFQ Scores and SF-12 Scores | 54 |
| Table 4.22 | Hypothesized and Observed Correlations Between ACFQ Scores and Clinical Variables | 55 |
| Table 4.23 | Hypothesized and Observed Correlations Between TCFQ Scores and Clinical Variables | 56 |
| Table 4.24 | Hypothesized and Observed Correlations Between ACFQ Scores and HRQOL Variables | 57 |
| Table 4.25 | Hypothesized and Observed Correlations Between TCFQ Scores and HRQOL Variables | 58 |
| Table 4.26 | Percentage of Correctly Hypothesized Relationships | 59 |

## LIST OF FIGURES


| | | PAGE |
|---|---|---|
| Figure 4.1 | Adult EQ-5D Scores | 44 |
| Figure 4.2 | Teen EQ-5D Scores | 45 |

# I. INTRODUCTION

The impact of chronic diseases, such as cystic fibrosis (CF), is often assessed through mortality statistics and clinical measures of physiologic functioning. More recently, however, increasing attention is being paid to the personal burden of illness and the impact on health-related quality of life (HRQOL) when living with a disease. Consumers, governments, and payers in health care today are looking to health care providers to evaluate medical therapies using outcome measures that are more global and incorporate the patient's own perception of their health status and functioning.

Instruments designed to measure HRQOL have been used in a variety of settings, including clinical trials and cross-sectional studies involving patients with chronic diseases. HRQOL is measured using both generic and disease-specific instruments. Generic instruments are used to assess and compare HRQOL in various diseases or conditions, while disease-specific measures are used to assess HRQOL within only that disease. Generic instruments allow for comparisons between different patient groups or diseases, but are considered less responsive to changes in health. Disease-specific instruments, on the other hand, are more likely to detect smaller, but important, changes in patients with a condition or disease. Generic instruments are further classified as either profile measures or index measures. Profile measures group items into domains of functioning, while index measures provide a single number, or index, representing the overall impact of HRQOL.

CF is a genetic disease affecting approximately one in every 2,500 live births, with one in 25 being carriers of the defective gene. The basic defect in CF is abnormal chloride ion transport, which results in increased viscosity of mucus secretions. Because chloride ion channels are so widespread in the body, the physiologic impact of CF affects numerous systems. Pulmonary disease is primarily responsible for the morbidity and mortality in patients with CF. Other systems affected by the defective gene include the digestive, musculoskeletal, and reproductive systems. CF is quite variable with respect to both the systems involved and the severity of the symptoms.

The literature on HRQOL and on the management of CF highlights the lack of available instruments specific to CF. While general HRQOL instruments have been used in this population, there is concern that they lack the sensitivity to detect subtle, but important, differences in the symptoms related to new treatments for CF. Therefore, the objective of this study was to develop a disease-specific HRQOL instrument for people with CF.

In this study, the CF-specific HRQOL instrument will be designed and tested for discriminative purposes in a cross-sectional assessment of patients. It will be used to discriminate between health states of patients at one point in time. It is possible that such an instrument could be used for evaluative (examining changes within an individual over time) and predictive (used for prognosis) purposes as well, but

further assessment of the measurement properties (i.e. test-retest reliability, responsiveness) will be required.

## II. BACKGROUND

### 1. HEALTH-RELATED QUALITY OF LIFE

Quality of life (QOL) is defined as "physical, social and emotional aspects of a patient's well-being that are relevant and important to the individual" (Glossary in *PharmacoEconomics* 1998). This definition is based primarily on the multidimensional concept of health, as portrayed by the World Health Organization's definition of health as "a state of complete physical and mental and social well-being, and not merely the absence of disease or infirmity" (WHO, 1958). HRQOL is further defined as "QOL measures that are likely to be influenced by health interventions" (Glossary in *PharmacoEconomics* 1998). HRQOL has also been defined as "those aspects of QOL that can be attributed to illness and its consequent therapy" (MacKeigan and Pathak, 1992). It is also defined as "patients' appraisals of their current level of functioning and satisfaction with it compared to what they perceive to be ideal" (Berzon, 1998).

It is generally agreed that HRQOL is a multidimensional construct that includes several core factors (e.g. physical function and symptoms, emotional state, activities of daily living) (Quittner and Munzenberger, 1999a). It should be based on the patient's perspective, rather than that of the health care professionals. It should also reflect the individuals' subjective evaluation of their daily functioning and well-being (Quittner and Munzenberger, 1999a).

Measures of HRQOL are generally used for three purposes: discriminative, evaluative, or predictive (Feeny et al., 1996). Discriminative measures determine differences in health status within populations (i.e. between-subject differences at a single point in time). Evaluative measures examine changes within an individual over time. Predictive measures are used for prognostic purposes. With these general purposes in mind, HRQOL instruments are typically described by the scope of HRQOL measured, and by the type of scores produced.

#### (A) TYPES OF INSTRUMENTS

Within HRQOL measures, a broad classification of instruments is based on the scope of health dimensions measured. Instruments may be categorized as disease-(condition-) specific instruments or generic instruments. Generic instruments are used to assess and compare HRQOL in various diseases or conditions, while disease-specific measures are used within that disease only. An advantage of disease-specific instruments is that they are able to detect smaller, but important, changes in patients with the condition or disease, whereas generic instruments may not be as responsive

to changes in health. An advantage of generic instruments is that they allow for comparisons between different conditions or patient populations.

Generic instruments are further classified into two categories, based on the type of scores produced: health profiles and preference-based index measures. Health profiles are comprised of multiple items that are grouped into different domains of functioning and can be used in almost any population. The domains of health and functioning represented in the profiles are presented separately, which provides clinicians and researchers information on the impact of diseases or treatments on different aspects of HRQOL. The classic example of a health profile measure is the Medical Outcomes Study Short-Form 36 (SF-36) (Ware and Sherbourne, 1992).

Preference-based measures, on the other hand, provide a single number, or index, representing the net, aggregate impact of physical, emotional, and social functioning on HRQOL. In effect, a single overall value is being assigned to the health state or level of well-being of the individual. This single overall index may be obtained directly through techniques such as standard gamble (SG) or time trade-off (TTO) interviews, or by using visual analog scales (VAS) (O'Brien, 1994). Preference-based index scores can also be obtained using 'indirect' measures which are multiattribute index systems, such as the Quality of Well-Being (QWB) Scale (Kaplan et al., 1989), the Health Utilities Index (HUI) (Feeny et al., 1996), and the EuroQol (EQ-5D) (Kind, 1996). Preference scores can be used as an outcome measure by themselves, but also as the adjustment factor in the calculation of quality adjusted life years (QALYs) in cost-utility analyses.

### (B) INSTRUMENT ADMINISTRATION

Instruments may be administered by a trained interviewer or self-administered by the subject/patient. An interview can take place face-to-face or over the phone. When self-administered, an instrument can be completed in the clinic setting or it can be mailed out to the individuals. There are advantages and disadvantages to these various methods (Guyatt et al., 1993; Streiner and Norman, 1995). When administered by trained interviewers, more resources are required, but there are typically fewer errors and missing responses. Self-administered questionnaires are much less expensive, but there are more missing responses and lower response rates. One compromise is to have a questionnaire self-completed under supervision (Guyatt et al., 1993). Another is to perform a telephone-interview, although, in this case, the questionnaire must be of a relatively simple structure (Streiner and Norman, 1995). Computer-assisted telephone interview (CATI) systems are available, which allow for more complicated telephone interviews, and have the added advantage of reducing data entry requirements. In using these compromises, errors and missing data can be minimized, while efficiently using available resources. (Guyatt et al., 1996)

A further extension on instrument administration is computerization. One instrument that is currently being developed for computer administration is the Pediatric Asthma Quality of Life Questionnaire (PAQLQ) (Juniper et al., 1996a). Software versions of the PAQLQ are being developed for hand-held touch screen computers. Computers should prove to be an efficient way of gathering HRQOL data. Initially, resources will be required to set up computer systems, but after the initial outlay, fewer resources will be required to administer the instruments. The result will be much cleaner and more complete data, as well as time saved manually inputting data. Overall, a comprehensive computer-administered questionnaire will make the administration of HRQOL instruments much more efficient and provide more accurate and timely data.

## 2. INSTRUMENT DEVELOPMENT

The process of developing a disease-specific HRQOL instrument involves several distinct steps: specify measurement goals, item generation, item reduction, questionnaire formatting, and instrument testing (DeVellis, 1991; Juniper et al., 1996b).

### (A) SPECIFY MEASUREMENT GOALS

A prerequisite to designing a good survey instrument is determining what the instrument is supposed to measure (Fowler 1993). Juniper et al. (1996b) suggest the following criteria: (i) clearly define inclusion and exclusion criteria to identify the study population, (ii) determine the primary purpose of the instrument (evaluative, discriminative, or predictive), (iii) define the aspect(s) being studied (e.g. physical, emotional, social), (iv) determine the format of the instrument (interviewer- or self-administered, phone or in-person, number of items, etc.) (Juniper et al., 1996b).

### (B) ITEM GENERATION

After the goals are established, the next step is to construct a list of all items that are of relevance to the study population. It is from this list that items for the final questionnaire will be drawn. DeVellis states that content redundancy within the item pool is an asset, since the pool should contain many items (DeVellis, 1991). Methods used to generate relevant items include: literature reviews, discussions with health care professionals, interviews with affected individuals, focus groups, and a review of other similar questionnaires or instruments (Juniper et al., 1996b). Fowler suggests conducting a focus group, because this will ensure that the concepts identified by the research are, in fact, important to the study group (Fowler, 1993).

Attempts should be made to recruit approximately 6 to 8 subjects who represent the full spectrum of patients with the disease. Having the item pool reviewed by experts, who are knowledgeable in the content area, will contribute to content validity (DeVellis, 1991). The experts can rate the relevance of items, the clarity and conciseness of items, and identify ideas that may have been missed.

### (c) Item Reduction

The next step in questionnaire development is to reduce the number of items from the list to include only those items that are most suitable for the final instrument. There are two approaches to item reduction (Juniper et al., 1996b; Juniper et al., 1997): clinical impact testing or factor analysis. The impact method selects items that are most frequently perceived as important by patients whereas the psychometric method (i.e. factor analysis) selects items mainly according to their correlation with one another (Juniper et al., 1997).

Clinical impact testing asks patients to identify those items that they have experienced as a result of their illness. The results are expressed as *frequency* (proportion of patients experiencing that item), *importance* (the mean importance score attached to the item), and *impact* (the product of frequency and importance) (Juniper et al., 1996b). The items can then be ranked and those items with lower impact scores can be eliminated (Juniper et al., 1997).

Factor analysis, on the other hand, is based on inter-item correlations / covariances to determine which items should be included in the instrument (Fayers and Hand, 1997). In factor analysis, items that have high correlations with each other are grouped together. Those items that do not correlate with the others are excluded from the final questionnaire. A disadvantage of using factor analysis is that the excluded 'orphan' items may be items that are important to the patients (Juniper et al., 1996b). It has been suggested that factor analysis is appropriate to use when a scale consists solely of psychological items, but difficulties arise when the scale includes items that relate to symptoms or side effects (Fayers and Hand, 1997).

Regardless of the method used for item reduction, once the items have been chosen for the final questionnaire, they are often grouped into domains or dimensions, such as physical functioning, emotional functioning, or symptoms. The intent of identifying domains or scales of related items is to improve the statistical properties of the outcome scores being produced. The easiest method is to review the items and group them according to clinical experience or by the domains in established instruments (Juniper et al., 1996b). An alternative method is to use factor analysis and base the grouping on correlations between items (Fayers and Hand, 1997).

## (D) QUESTIONNAIRE FORMATTING

The items in the questionnaire need to be in a form that will facilitate interviewer- or self-administration. Often easy, straightforward questions are put at the beginning and questions that are sensitive or require more thought are put in the middle or end (Fowler, 1993). The main goal should be to make the questionnaire easy to use. In the case of a self-administered questionnaire, Fowler (1993) suggests six principles for questionnaire formatting: (i) make it self-explanatory, (ii) restrict it to closed answers, (iii) use few different types of question forms, (iv) type it and lay it out clearly, (v) minimize skip patterns, (vi) repeat information to ensure no confusion (Fowler, 1993).

Wording of the questions is important. The words should be understood by all respondents or defined, if necessary. Inadequate wording can occur when the words do not form a complete question. If the respondents have to add words to understand a question, the meanings change and the respondents are no longer answering the same questions (Fowler, 1993).

The selection of response options refers to the categories of scales that are available for responding to the questionnaire items (Juniper et al., 1996b). The main types of response formats are: (i) Likert scale (response options indicate varying degrees of agreement with the statement), (ii) semantic differential (pairs of opposite adjectives with lines in between for responses), (iii) visual analog scale (response on a continuous line between a pair of descriptors at opposite ends of a spectrum), and (iv) binary options (choice between two responses) (DeVellis, 1991).

It is also important to specify the time period for the questions. Patients should be asked how they have been feeling over a specified period of time. Juniper et al. (1996b) use two weeks in most of their instruments on the basis of intuitive impression that two weeks is the most that patients can accurately recall. Other time frames that are often used include four weeks and one week recall periods.

## (E) INSTRUMENT TESTING

Once the questionnaire is nearly ready to use, it is often pretested on a few patients to ensure that all items are understood and have the correct wording and formatting (Juniper et al., 1996b). This process will show how the data collection protocols and the instruments work under realistic conditions (Fowler, 1993). The respondents should be drawn from a population that is similar to the population in which the survey will be used. DeVellis (1991) recommends testing the questionnaire on a larger group of people to ensure adequate representation of the population for which it is intended and to increase the accuracy of internal consistency tests (DeVellis, 1991). This situation would allow initial testing of the

instrument's measurement properties, reliability and validity, which are discussed in more detail in the following section.

## 3. PSYCHOMETRIC PROPERTIES

Psychometrics is the measurement of psychological constructs (DeVellis, 1991; Hays et al., 1993). Because HRQOL is considered a multidimensional construct, there has been considerable attention paid to the psychometric, or measurement, properties of HRQOL instruments. The psychometric properties of any instrument are important to determine if the measure is adequate for clinical purposes. Two important measurement properties in the evaluation of HRQOL instruments are reliability and validity.

### (A) RELIABILITY

The reliability of a measure indicates the degree to which the scores represent the "true" HRQOL, that is the ratio of "signal" to "noise" in the measurement. Reliability is considered by some to be the fundamental issue in psychological measurement and is defined as the proportion of variance of the latent variable attributable to the true score (DeVellis, 1991). The usual tests of reliability are internal consistency and test-retest. Test-retest replicates measurements over time, whereas internal consistency attempts to replicate measurements within the same, single administration.

Internal consistency reliability is assessed using Cronbach's $\alpha$ coefficient, which represents the average of the correlations among all the items in the measure (Cronbach, 1951). It is calculated to determine the degree to which separate items within domains are measuring the same construct. Reliability coefficients range from 0 to 1. A higher value indicates a higher level of homogeneity of the items within that scale. An $\alpha$ coefficient exceeding 0.90 is considered an acceptable level of reliability when comparing individuals (Streiner and Norman, 1995), while 0.70 is acceptable for comparison at the group level (Nunally, 1979). These represent general rules of thumb; some authors suggest these may be too stringent (Hays et al., 1993).

Test-retest reliability is the relationship between scores obtained by the same person on two or more separate occasions (Hays et al., 1993). For continuous data, the Pearson product moment correlation coefficient (r) is often used. The Pearson coefficient indicates the extent to which individuals who scored high on the initial assessment also score high on the repeat assessment, and the extent to which those who score low on one assessment also score low on the other assessment (Hays et

al., 1993). The intraclass correlation coefficient (ICC) assesses not only the strength of correlation, but also whether the slope and intercept vary from those expected (Deyo et al., 1991). The ICC coefficient is derived using ANOVA, whereas the Pearson coefficient is based on regression analysis (Streiner and Norman, 1995). The disadvantage of the Pearson coefficient is that the measurements may be systematically different, and yet highly correlated (Deyo et al., 1991). But in practice, because the error is usually due to random variation, the Pearson and ICC correlations will be very close (Streiner and Norman, 1995).

### (B) VALIDITY

The validity of an instrument indicates the degree to which it actually measures what it purports to measure and if it is useful for its intended purpose. Validity is mainly assessed in terms of content validity, criterion validity, and construct validity, with further divisions therein. Content validity is defined as "the extent to which a specific set of items reflects a content domain" (DeVellis, 1991, 43). It essentially asks the question, 'Does the instrument sample all of the relevant or important domains?' A closely associated form is face validity, which indicates whether the instrument appears, on the face, to be assessing what it was intended to assess.

Criterion validity is defined as "the correlation of a scale with some other measure of the trait or disorder under study, ideally, a 'gold standard' which has been used and accepted in the field" (Streiner and Norman, 1995, 147). It is an empirical, not necessarily a theoretical, relationship with the criterion or gold standard. It is often divided into two types: concurrent validity and predictive validity. With concurrent validity, the new scale is correlated with the criterion measure, both of which are given at the same time. In predictive validity, the criterion will not be available until some time in the future (Streiner and Norman, 1995). The problem with criterion validity is that a 'gold standard' with which to compare the new instrument often does not exist. This is particularly true in the measurement of HRQOL.

Construct validity "is directly concerned with the theoretical relationship of a variable to other variables" (DeVellis, 1991, 46). For example, the new instrument's relationship could be compared to existing health measures. Construct validity is often divided into two types: convergent validity and discriminant (or divergent) validity. Convergent validity examines how closely the new scale is related to measures of theoretically related constructs, whereas discriminant validity examines the absence of correlation between measures of unrelated constructs (DeVellis, 1991, 50). An additional measurement property that is often referred to is responsiveness, or the ability of a measure to detect changes in health status when they do occur. While some authors consider this a separate measurement property, it could also be considered a form of construct validity (Hays et al., 1993).

## 4. CYSTIC FIBROSIS

CF is a recessively transmitted genetic disease affecting approximately one in every 2,500 Canadian Caucasian live births, with 1 in 25 being carriers of the defective gene (Corey and Farewell, 1996). The incidence of CF in the U.S. was initially estimated as 1 in 2,500 white live births, but more recent studies have suggested a lower incidence of 1 in 3,500 white live births (Knowles et al., 1999; FitzSimmons, 1994). Patients suffer from generalized dysfunction of exocrine glands, resulting in a wide variety of clinical symptoms. The main symptoms are chronic progressive lung disease, maldigestion due to pancreatic enzyme insufficiency, and markedly elevated sweat chloride concentration (Corey and Farewell, 1996).

The CF gene was identified in 1989 (Corey and Farewell, 1996). Since then, over 750 mutations in this gene have been discovered resulting in the clinical picture of CF (Knowles et al., 1999). The CF gene codes for a protein called the CF transmembrane conductance regulator (CFTR), which is a chloride ion channel found in many cells throughout the body. The basic defect in CF is abnormal chloride ion transport, which results in increased viscosity of mucus secretions. Because chloride ion channels are so widespread in the body, the physiologic impact of CF affects numerous systems (Tullis and Guyatt, 1995).

Pulmonary disease is primarily responsible for the morbidity and mortality in patients with CF. Increased viscosity and decreased mucocilliary clearance of sputum creates an ideal environment for chronic lung infection and bacterial colonization (Gilligan, 1999). *Staphylococcus aureus* (*S. aureus*) is the most common pathogen in patients younger than one year of age (Fitzsimmons, 1994). The majority of patients acquire infections with *Pseudomonas aeruginosa* (*P. aeruginosa*) which contributes to bronchiectasis and progressive obstructive airway disease (FitzSimmons, 1994). *Burkolderia cepacia* (*B. cepacia*), although much less prevalent, is considered to be a more virulent pathogen than *P. aeruginosa*, with patients experiencing a more severe course of pulmonary disease and rapid deterioration (FitzSimmons, 1994).

Other systems affected by the defective gene include the digestive, musculoskeletal, and reproductive systems. Complications of CF, apart from the pulmonary symptoms, include pancreatic insufficiency in 85% of patients leading to malabsorption of fat and malnutrition, diabetes mellitus in 8 to 15 % of patients, biliary cirrhosis, cholelithiasis, sinusitis and nasal polyps, subacute bowel obstructions, arthritis, and infertility (FitzSimmons, 1994).

CF is a chronic disease that is quite variable with respect to both the systems involved and the severity of the symptoms. The variability is due in part to the various genetic mutations, but also to environmental and treatment factors. Patients with CF generally experience a slow deterioration over time, although there is much

variability between and within CF patients (Tullis and Guyatt, 1995). The range of the disease's impact on people with CF includes an asymptomatic level with no outward appearance of ill health, to having symptoms of an acute pulmonary exacerbation with an increasingly severe cough, increased volume and purulence of sputum, dyspnea, low grade fever, weight loss, rising leukocyte count, and declining pulmonary function (Gilligan, 1999). Some patients also experience chest deformity, clubbed fingers and toes, and may show growth retardation and malnourishment.

Therapy for CF usually involves antibiotic treatment, pancreatic enzyme therapy, nutritional support, and chest physiotherapy. Inhaled bronchdilators, rhDNase, and anti-inflammatory treatment can also be used. For patients with end-stage lung disease, bilateral lung transplantation may be the only recourse (Resnikoff and Conrad, 1998). Emerging therapies include attempts to correct the genetic defect. Treatments often pose a large burden to patients, both in terms of time and cost.

With treatment, survival time has improved steadily from death in early infancy in the 1940s, to ten years in the 1960s, to a median survival of 32 years in 1992 (Corey and Farewell, 1996; FitzSimmons, 1996). The 1980-1989 median survival age in Canada was 23 years for females and 30 years for males (FitzSimmons, 1994). The reasons for which females experience poorer survival are not yet determined, although poorer weight maintenance has been mentioned (Corey and Farewell, 1996).

Epidemiologic studies of Canadian CF patients indicate that the most significant predictor of mortality was $FEV_1$ (forced expiratory volume in one second), but age, gender, weight, and bacterial infection were also important predictors (Kerem et al., 1992; Corey and Farewell, 1996). Age and gender adjusted relative risk of death within two years is estimated to be 2.0 for each decrement in the $FEV_1$ of 10 percent below the predicted value (Kerem et al., 1992). A similar doubling of the risk of death were seen among patients 10 years younger than other patients with the same $FEV_1$, and among females as compared to male patients (Kerem et al., 1992). Also an important predictor of mortality of CF patients in Canada is colonization status with *P. aeruginosa* and *B. cepacia* (Corey and Farewell, 1996).

## 5. Clinical Outcome Measures in CF

Typical outcome measures in CF include pulmonary function tests, chest radiographs, number of acute pulmonary exacerbations, survival, and clinical scoring systems (e.g. NIH Score). Several of these measures will briefly be reviewed in turn below. The early clinical scoring systems (e.g. NIH Severity Index), that were first attempts at global, prognostic measures for this population, are still routinely used in periodic monitoring of CF patients. Confounding variables may affect outcome measures. Confounding variables include: genotype, age, gender, bacterial

colonization, environmental smoke exposure, airway reactivity, pancreatic function, hepatobiliary disease, and nutritional status (Ramsey and Boat, 1994).

### (A) SPIROMETRY

Spirometry measures pulmonary function. In obstructive diseases, the $FEV_1$, FVC (forced vital capacity), and $FEF_{25-75}$ (forced expiratory flow in middle half of FVC) have been shown to be the most discriminating measures. These tests can be performed on children over 5 years old. The techniques for performing spirometry tests are well established, with established normal values and information about inter-subject variability for normal subjects (Ramsey and Boat, 1994). Equipment requirements have also been standardized. The data indicated that FVC, $FEV_1$, and derived ratios are reproducible, but not particularly sensitive to early disease (Ramsey and Boat, 1994). Children with CF could have stable spirometry values for many years. Pulmonary function measures are useful for assessing the rate of decline of pulmonary function with time, as well as the improvement in pulmonary function with various treatment strategies (Ramsey and Boat, 1994). Pulmonary function tests are objective, reproducible, easy to perform, correlate with clinical symptoms and survival in patients with CF, and are therefore in common use, but they cannot be administered to children younger than 6 and do not capture exercise capacity and tolerance (Tullis and Guyatt, 1995).

### (B) BODY MASS INDEX (BMI)

Adequate nutrition, along with optimal treatment of pulmonary infections, is important in maintaining the health of people with CF (Nir et al., 1996). Improved survival has also been associated with better nutritional status in people with CF (Bell et al., 1998). Nutritional status can be measured with the BMI. Weight and height are used to determine BMI scores, which are calculated as weight (in Kg) over height (in m) squared ($W / H^2$). BMI scores of less than 19 are generally considered as indications that the person is underweight, while scores over 30 are generally considered to indicate the person is overweight. Scores in the middle are considered 'normal'.

Bell et al. (1998), in a study of CF patients in Australia, found that patients with CF were significantly under weight, compared to healthy individuals, but were of similar height. They also found that $FEV_1$ and FVC were significantly related to BMI. Their results confirm that young adult patients with CF were significantly under weight and that declining health was associated with significant weight loss (Bell et al., 1998).

Nir et al. (1996) found that CF patients in their clinic in Copenhagen had normal height, although final height was achieved a little later than in healthy

controls. Weight was lower than normal in males above 15 and in females above 10 years old. BMI was found to be approximately 98% of normal in the younger patients, but declined to 90% in adult men and to 83% in adult women with CF. BMI was also strongly correlated with lung function parameters (Nir et al., 1996).

### (C) EXERCISE ENDURANCE

In CF and other respiratory illnesses, simple tests of exercise endurance have been developed. These involve walking in a hallway or on a treadmill, or cycling, either for a set amount of time or until exhaustion. Walking test have been shown to correlate highly with cycle ergometer measures (Guyatt, 1985). Guyatt also found the walking test to be a better indicator of functional status than the lab test. Based on these results, the walk test seemed to be the test of choice as a measure of functional exercise capacity and was explored further.

Butland et al. (1982) demonstrated that the two-minute walking test, like the six- and twelve-minute walking tests, was reproducible and a useful test of exercise tolerance. Results on all three tests by the same patient correlated highly with each other. They concluded that the shorter times discriminate slightly less well (variance was less) but also have less of a training effect. Shorter tests have significant benefits, and may be substituted for the longer test.

Upton et al. (1988) validated the two-minute walking test in children with CF, comparing the CF children to normal children. They found that the walking distance varied with height for both populations, and that the test results were reproducible in the CF population.

Gulmans et al. (1996) evaluated the reproducibility of the 6-minute walking test in 23 children with CF. They performed two standardized 6-minute walk tests with one week between tests. They found no significant differences between the two walking distances reached and also a strong correlation between the two walking distances reached by the individuals. They also validated the test by having 15 children undergo standardized maximum incremental exercise testing on a cycle ergometer and a 6-minute walk test. A significant correlation was found between the walking distance reached and the maximum workload or maximum oxygen uptake. They concluded that the 6-minute walking test was a valid and useful test in children to assess their exercise tolerance and endurance (Gulmans et al., 1996).

Guyatt et al. (1984) studied the effects of encouragement on walking test performance in a randomized study of 43 patients. They were randomized to receive or not receive encouragement as they performed serial 2- and 6-minute walk tests every two weeks for ten weeks. They found that simple encouragement improved performance ($p<0.02$ for the 6-minute walk test). They concluded that there needs to be careful standardization of the performance of the walk tests (Guyatt et al., 1984).

### (D) NIH Clinical Severity Score

The NIH Clinical Severity scoring system is a widely used clinical research measure and has been used for comparison in the assessment of HRQOL tools. The points sum to a total score as a measure of disease progression. It has a maximum score of 100 and is divided into two sections: pulmonary and general condition. The total score depends more heavily on the pulmonary condition (75 of the 100 possible points). A score of 80-100 indicates mild disease, a score of 60-80 indicates moderate functional impairment, and a score of less than 60 indicates severe disease and poor prognosis (Smith et al., 1983).

The pulmonary portion of the scoring system includes points based on chest X-rays, pulmonary function tests, pulmonary exacerbation, pneumothorax, hemoptysis, pulmonary surgery, cor pulmonale, physical examination of the lungs, and sputum production and/or cough. The general condition includes points for symptoms related to weight and appetite, functional endurance, dyspnea, treatment compliance and depression (Taussig et al., 1973). Sockrider et al. (1994) used a modified NIH score that had more clearly specified criteria, while retaining the original weightings and structure.

## 6. Generic Health-Related Quality of Life in CF

The literature on HRQOL in CF was identified through electronic literature searches as well as through the bibliographic references found within the selected articles. An electronic literature search was performed using MEDLINE (1966 – 1999), HealthSTAR (1975 – 1999), EMBASE (1988 – 1999), CINAHL (1982 – 1999), and PsycINFO (1984 – 1999). A combination of MESH subheadings and keywords were used in the search strategy to identify articles that discussed both HRQOL and CF. 250 articles were identified, of which 218 were originals. (Some duplication was found to exist between the bibliographic databases.) Of these 218 articles, 65 were studies of HRQOL in CF and were, therefore, relevant to this review. Within the group of 65 articles, several review articles were found that give an overview of HRQOL assessment in CF (Abbott et al., 1997; Abbott et al., 1998; Goa and Lamb, 1997; Quittner, 1998; Sennhauser, 1997; Tullis and Guyatt, 1995).

HRQOL has been evaluated in CF patients using several generic HRQOL instruments. Certain investigations have evaluated interventions such as drug therapy and lung transplantation. The following is a review of the generic instruments that have been used in assessing HRQOL in CF.

(A) CHILD HEALTH QUESTIONNAIRE (CHQ) (Britto et al., 1999; McGarrahan et al., 1999; Powers and Abetz, 1997; Powers, 1998)

The Child Health Questionnaire (CHQ) is a generic instrument that assesses a child's physical, emotional, and social well-being. It compares children's health status and changes over time across general and specific populations. There are parent forms and child forms for children over ten years of age. It measures the following domains: general health, change in health, physical functioning, bodily pain or discomfort, limitations in school work and activities with friends, behaviour, mental health, self-esteem, emotional/time impact on the parent, limitations in family activities, and family cohesion (Powers, 1998). The scores range from 0 to 100, with the higher scores representing better perceptions of health (Powers, 1998).

In an abstract, Powers and Abetz (1997) briefly described their use of the CHQ in assessing child and maternal reports of HRQOL as it related to pulmonary function in 32 adolescents with CF. They found that mothers' reports of HRQOL were not related to pulmonary function, but that the adolescents' reports on several domains (general health, physical functioning, role-social limitations due to emotional difficulties and due to physical health) were related to $FEV_1$.

Powers (1998) again used the CHQ to assess to differences among adolescent, mother, and father perceptions of child health in 24 adolescents with CF (Powers, 1998). All three groups reported significant positive relationships between pulmonary function and perceptions of general health and physical health, but pulmonary function did not relate to the psychosocial, emotional, or behavioral health scales (Powers, 1998).

In a recent abstract, Britto et al. (1999) used the CHQ Parent Form to determine the relationship between physical and psychosocial HRQOL and clinical disease severity measured by $FEV_1$, 6-minute walk distance, growth and pulmonary exacerbations. They found no significant associations between physical or psychosocial QOL scores and the variables, except pulmonary exacerbations that were associated with lower physical QOL (Britto et al, 1999).

Also in an abstract, McGarrahan et al. (1999) administered the parent form of the CHQ to the mother or father of 83 children and adolescent patients. They compared the scores to normative data from three samples of children diagnosed with asthma, juvenile rheumatoid arthritis (JRA), and epilepsy. In comparison to these three groups, the CF group reported significantly poorer health and greater limitations due to physical health problems (McGarrahan et al., 1999).

(B) EUROQOL (EQ-5D) (Busschbach et al., 1994; Connolly et al., 1998; Johnson et al., 1998; Johnson et al., 1999)

The EuroQol (EQ-5D) provides a multi-dimensional descriptive system of health status. Its five dimensions are: mobility, self-care, usual activity, pain/discomfort, and anxiety/depression. A previously developed scoring system, based on population preferences for health states described by the EQ-5D system, is applied and a single preference-based index is generated (Kind, 1996). The EQ-5D also includes a visual analog scale (EQ-VAS) as a means of valuing the respondent's health state within the descriptive system. The endpoints of the VAS are labeled 'best imaginable health state' and 'worst imaginable health state' anchored at 100 and 0 respectively.

Johnson et al. (1999) examined a group of 39 adults with CF. They found that the EQ-5D scores for the adults with CF were lower than those for the general population norms. $FEV_1$ % predicted (forced expiratory volume in one second as a percentage of the value predicted for normal subjects of the same sex and height) was positively correlated with the EQ-5D scores. Regression analysis indicated that age, $FEV_1$ % predicted, hospital admission, and the use of rhDNase were all positively associated with EQ-5D scores. BMI was negatively associated with the scores. However, the magnitude of the regression coefficients suggested that only hospital admission in the previous year was quantitatively important.

In a pilot study of six patients, Busschbach et al. (1994) used the EQ-5D to assess HRQOL before and after lung transplantation. They did not provide many details of their results, but the values for the EQ-VAS were reported to be higher after the transplant.

(c) "EVERY DAY LIFE" OR "*ALLTAGSLEBEN*" (French, 1998; Staab et al., 1997; Staab et al., 1998; Wenninger et al., 1997)

The "Every Day Life" Questionnaire ("*Alltagsleben*") is a generic HRQOL instrument developed in Germany. It has 42 items with six subscales assessing physical, emotional, social and functional components of HRQOL, as well as joy of life and satisfaction with medical care. The total score is composed of all 42 items and can be used as an outcome measure providing a summary of overall HRQOL. (Staab et al., 1998)

Staab et al. (1998) used the "Every Day Life" Questionnaire in a sample of 89 adolescents and adults with CF and 125 parents of children with CF to investigate relationships between HRQOL and severity of disease, health perception, and coping. The HRQOL score was not significantly correlated with socioeconomic status. Regression analyses were used to assess whether relationships existed between HRQOL and perception of health or ways of coping. The results indicated that subjective health perception and social comparison were the strongest predictors of HRQOL.

(D) FUNCTIONAL STATUS II[R] (FSII[R]) (Connolly et al., 1998; Johnson et al., 1999)

The Functional Status II[R] (FSII[R]) examines the physical, psychological, and social aspects of children's functioning. It has been modeled from the original FS I (which was modeled on the Sickness Impact Profile (SIP)) into the FSII[R], which has both long (43-item) and short (14-item) versions (Stein and Jessop, 1990).

Johnson et al. (1999) studied a group of 69 children with CF. Lower baseline FSII[R] scores were observed in the group of children with CF than those for the general population norms. Differences were seen in the baseline FSII[R] scores between children with CF who were hospitalized and those who were not. BMI was positively correlated with the baseline FSII[R] scores, while lung function was not significantly correlated. A follow-up survey was conducted and parents reported a larger change in health status on the FSII[R] for children who were hospitalized during 1998 then those not hospitalized. Regression analysis indicated that the change in FSII[R] scores were positively associated with baseline health status, but not with other demographic or clinical variables.

(E) NORDIC QUALITY OF LIFE QUESTIONNAIRE (Lindstrom and Kohler, 1991; Lindstrom and Eriksson, 1993; Lindstrom et al., 1994)

The Nordic Quality of Life Questionnaire is a general life quality questionnaire intended to measure all aspects of children's lives. Four life spheres are used: global, external, inter-personal, and personal. Included within these spheres are the following dimensions: physical, mental, spiritual, social, and economic. A set of baseline values has been established to form a standard of QOL for the Nordic population studied. (Lindstrom and Eriksson, 1993; Lindstrom et al., 1994)

Lindstrom et al. (1994) used the Nordic QOL Questionnaire to assess general QOL in children with CF from five Nordic countries. The differences between countries in QOL were small. Children with CF were found to have many more health problems than the general child population, but their overall QOL was not much lower (Lindstrom et al., 1994). No relationship between QOL scores and the severity of disease could be established.

(F) NOTTINGHAM HEALTH PROFILE (NHP) (Busschbach et al., 1994; Caine et al., 1991; Congleton et al., 1996; Congleton et al., 1997; Congleton et al., 1998; Dennis et al., 1993; Keilen et al., 1994; Mannes et al., 1997)

The Nottingham Health Profile (NHP) is a self-complete HRQOL questionnaire that measures perceived health problems and the extent to which they affect normal activities of daily life. Part 1 of the NHP has six dimensions: energy, pain, emotion, sleep, social isolation, and physical mobility, with higher scores indicating worse states of health. Part 2 has seven areas of daily living: employment, looking after the home, social life, home life, sex life, hobbies, and holidays. (Congleton et al., 1996)

Congleton et al. (1996; 1997) used the NHP with six additional CF-specific questions in a group of 240 patients aged 16 years and older. When compared with normal population scores, men with CF had significantly worse scores in the area of pain, energy, and social isolation, while women with CF had significantly worse scores in pain, emotion, and sleep (Congleton et al., 1996). The NHP dimensions were also compared to clinical variables. All six dimensions of Part I were significantly negatively correlated with '$FEV_1$ % predicted' and 'time able to work', and significantly positively correlated with 'shortness of breath', 'sputum volume', 'time on treatment', and 'time in hospital' (Congleton et al., 1996). BMI was significantly negatively correlated with the energy, sleep, and physical mobility dimensions (Congleton et al., 1996).

Congleton et al. (1998) obtained follow-up scores for 152 of the original 204 patients surveyed at an interval of 1, 2, or 3 years. The only dimension that showed a significant change over time was emotion, which showed a small improvement. There was also a significant deterioration in the CF-specific total score (Congleton et al., 1998). There was no overall difference in change in NHP scores between the patients whose $FEV_1$ declined and those whose did not (Congleton et al., 1998).

The NHP has also been used to assess HRQOL in CF patients before and after lung transplantation. Caine et al. (1991) and Busschbach et al. (1994) found significant improvements for the physical mobility and energy dimensions after transplant. Dennis et al. (1993) found that after transplant, there were significant improvements in physical mobility, energy, sleep, social isolation, and emotional reactions. Mannes et al. (1997) compared four groups of people with end-stage lung disease, one group being CF, and found that the mobility and energy dimensions improved after lung transplantation. Keilen et al. (1994) compared CF patients awaiting transplants with people with eating disorders and people with angina, and found that the patients with CF had a lower level of mobility, but were less impaired in the areas of emotional reaction and social isolation than the other groups (Keilen et al., 1994).

(G) PSYCHOSOCIAL FUNCTIONING INSTRUMENTS (Blair et al., 1994; Cowen et al., 1984; Moise et al., 1987; Sawyer et al., 1995; Simmons et al., 1985; Simmons et al., 1987; Smith et al., 1983)

While psychosocial functioning is only one part of HRQOL, several studies have specifically assessed the psychosocial aspect of HRQOL in CF. The following instruments have been used to assess psychosocial functioning in CF: the General Health Questionnaire, the Offer Self-Image Questionnaire, the Piers-Harris Self Concept Scale, and the Tennessee Self Concept Scale.

The General Health Questionnaire (GHQ-30) is a self reported screening tool for emotional disturbance. Blair et al. (1994) studied the psychosocial functioning of 29 adolescents and young adults with CF who still lived with their parents. The results indicated that most patients with CF were in good psychological health and differed from their healthy peers only in that they were less likely to be employed (Blair et al., 1994).

The Offer Self-Image Questionnaire is a self-administered questionnaire that measures psychological well-being and adjustment. The questionnaire has 11 subscales that record the adolescent's self-perception of personal mastery of the problems of adolescence. High ratings indicate maladjustment (Sawyer et al., 1995). Sawyer et al. (1995) used the Offer Self-Image Questionnaire to assess the psychological well-being and adjustment of adolescents with CF. The questionnaire was administered to 49 adolescents aged 14-18. They found no significant differences between males and females in pulmonary function or clinical scores, but growth and pubertal development were delayed in both sexes. They also found that females, but not males, with CF were less well-adjusted than their healthy peers (Sawyer et al., 1995).

The Piers-Harris Self Concept Scale (PH) is a well-standardized self-report measure consisting of 80 yes/no items that yield a total score indicating a positive or negative self-concept. Simmons et al. (1987) assessed behavioural problems in 108 children with CF. Twenty-three percent showed behavioural maladjustment. The results indicated that the children were able to function adequately, but showed the effects of the stress of chronic illness by displaying more behavioural problems.

The Tennessee Self Concept Scale (TSCS) is a well-standardized self-report measure consisting of 100 items, assessing positive and negative self-concept and self-criticism. There are 29 subscores that can be derived from the profile (Simmons et al., 1985). Cowen et al. (1984) used the TSCS on 176 older adolescents and adults (over 16 years old) and found normal self-concept except for scores of positive physical self and psychosis for patients over 20. The TSCF scores did not correlate with measures of disease severity, except for correlations between lung function and physical self-concept in older men (Cowen et al., 1984). The same group used the TSCS on 85 adolescents between 12 and 15 and found that they maintained good self-concept, were socially competent, and control of their health, while showing

more behavioural problems (Simmons et al., 1985). Smith et al. (1983) found that 26 adolescents between the ages of 12 and 18, scored in the 30th percentile of the normative group on the TSCS. In those with a NIH score of less than 70 (i.e. poor health status), there seemed to be a relationship between life change score and health status (Smith et al., 1983). Moise et al. (1987) used the TSCS on 73 adolescents and adults (aged 18 to 40) and found it correlated with coping style.

(H) QUALITY OF WELL-BEING SCALE (QWB) (Bartholomew et al., 1997; Czyzewski et al., 1994; Czyzewski et al., 1998; Dunlevy et al., 1994; Eakin et al., 1998; Kaplan et al., 1989; Munzenberger et al., 1996; Munzenberger et al., 1999; Orenstein et al., 1989; Orenstein et al., 1990; Orenstein and Kaplan, 1991)

The Quality of Well-Being Scale (QWB) is a multiattribute preference-based measure with three subscales (mobility, physical activity, and social activity) as well as a set of symptoms/problem complexes (Kaplan et al., 1989). It combines preference-weighted measures of symptoms and functioning to provide a numerical expression of well-being that ranges from 0 for death to 1 for optimum functioning, with higher scores representing better health states (Kaplan et al., 1989). Patients describe their limitations during daily life and a value is applied to the disutility associated with each limitation.

The QWB was administered to 44 CF patients aged 7 to 36 years and found to be significantly positively correlated with three pulmonary function test results ($FEV_1$, $FEF_{25-27\%}$, PEFR) and exercise performance (peak $VO_2$), while negatively correlated with age (Orenstein et al., 1989). After controlling for disease severity ($FEV_1$), the relationship between QWB and age became nonsignificant. In a second study, Orenstein et al. (1990) administered the QWB to a group of 28 CF patients over ten years old before and after a two-week course of oral ciprofloxacin used to treat pulmonary exacerbations. They found significant positive correlations between changes in QWB and pulmonary function tests ($FEV_1$, FVC, $SaO_2$) (Orenstein et al., 1990).

Czyzewski et al. (1994) used the QWB to collect health status ratings for adolescents with CF from the parents and adolescents. The results indicated, for both parents and adolescents, that the QWB did not correlate significantly with spirometry scores, but that clinical health status (represented by the NIH score) was significantly positively correlated with QWB (Czyzewski et al., 1994). Parental reports of general pulmonary factor, weight factor, disability factor, and impact on family were all significantly negatively correlated with QWB, while adolescents' reports of psychosocial factor and socialization were significantly negatively correlated with QWB (Czyzewski et al., 1994). From what appears to be the same data set, Czyzewski et al. (1998) provided the following results: QWB reported by parents and adolescents was significantly positively related to the NIH score; QWB reported

by adolescents was statistically positively correlated with weight, but not correlated with height (Czyzewski et al., 1998).

More recently, the responsiveness and validity of the QWB was evaluated in a sample of 20 children and adolescents, aged 9 to 29 years, experiencing acute exacerbations (Munzenberger et al., 1999). The QWB was administered immediately before and after hospital admission and at 6- and 12-month follow-ups. Results indicated that the overall QWB score, the physical and social function scores, and the symptom-problem complex scores were responsive to the changes before and after acute treatment. However, only the symptom-problem complex scores changed over the 12-month follow-up. When compared to pulmonary function in these patients, QWB scores were significantly correlated ($p<0.01$) with FVC ($r=0.476$) and RV:TLC (ratio of respiratory volume to total lung capacity) ($r=0.452$) and weakly correlated ($p<0.05$) with $FEV_1$ ($r=0.358$) and $FEV_{25-75}$ ($r=0.35$). There were no significant correlations when changes in QWB scores were considered (Munzenberger et al., 1999).

Munzenberger et al. (1996) reported significant improvements in QWB scores for 30 patients with mild CF (FVC > 70%) treated for two weeks with rhDNase. This improvement in HRQOL was observed despite a lack of significant change in pulmonary function tests.

Eakin et al. (1998) used the QWB scale to validate the Shortness of Breath Questionnaire (SOBQ) in 54 people with pulmonary disease, 9 of whom had CF. The results from the entire group, including those with CF, showed that the QWB score and the SOBQ score were negatively correlated.

Dunlevy et al. (1994) examined the effect of a structured low impact aerobic exercise program on six patients' work capacity, oxygen uptake, and HRQOL using the QWB. No significant differences were found in QWB scores or spirometry tests ($FEV_1$, FVC, $FEV_{25-75}$) after the program.

Bartholomew et al. (1997) tested the efficacy of the Cystic Fibrosis Family Education Program by using several measures, one of which was the QWB. No difference was found for the QWB scale over time.

(i) RAND CHILD HEALTH STATUS (Connolly et al., 1998; Johnson et al., 1999)

The RAND Child Health Status is a 7-item instrument, based on measures used in the RAND Health Insurance Experiment (Eisen et al., 1979), to assess the health status of children. The same researchers who developed the SF-36 developed the RAND Child Health Status instrument. The RAND study was developed in the late 1970s to measure physical, mental, and social components of health status and general health ratings for children aged 0 to 13 (Connolly and Johnson, 1999).

Johnson et al. (1999) studied a group of 69 children with CF. They found that the baseline RAND Child Health Status scores were lower than those for the general population norms. The baseline RAND scores were significantly lower for children who had a CF-related hospital admission in the previous 12 months. There were no significant correlations between the baseline RAND scores and lung function or BMI. A follow-up assessment was done, but no significant changes were seen with the RAND scores.

(J) RAND FUNCTIONAL STATUS INDEX (Shepherd et al., 1992)

One measure within the RAND Health Insurance Study (HIS) is functional status. The RAND Functional Status Index (FSI) is a 14-item questionnaire that assesses functional status. Many of these items were later incorporated into the Medical Outcomes Study. The questions were divided into four categories of limitation: mobility, physical activity, social role activity, and general (Shepherd et al., 1992).

Shepherd et al. (1992) used 12 questions on functional status from the RAND FSI to assess the health status of 37 adults with CF compared with 46 controls (Shepherd et al., 1992). The functional status of the CF group was significantly lower than that of the comparison group. The results of the FSI showed a significant positive correlation with self-rated health, current life satisfaction, acute symptom index, disability days, and hospital days, while it had a significant negative correlation with slow vital capacity (Shepherd et al., 1992).

(K) SF-36 (Blair et al., 1998; Britto et al., 1999; Epker and Maddrey, 1999; Gee et al., 1999b; Johnson et al., 1998; Johnson et al., 1999; Mellis, 1997)

The SF-36 is a commonly used health status profile measure. It includes eight multi-item health concepts or dimensions: physical functioning, role limitations due to physical problems, social functioning, bodily pain, mental health, role limitations due to emotional problems, vitality, and general health perceptions (Ware and Sherbourne, 1992). For each dimension, item scores are coded, summed, and transformed on a scale of 0 to 100, with higher scores indicating better health status. A Physical Component Summary (PCS) scale and a Mental Component Summary (MCS) scale can also be calculated (Ware et al., 1994).

Johnson et al. (1999) examined a group of 39 adults with CF. Baseline surveys were sent out, with follow-up surveys sent one year later. They found that the baseline SF-36 scores were lower than those for the general population norms. Differences in the baseline MCS scores were found for the three household income

groups, with lower incomes having lower scores. $FEV_1$ % predicted was positively correlated with the baseline PCS scores.

Mellis (1997) reported statistically significant improvements in both spirometry and HRQOL, using the SF-36, following three month's treatment with rhDNase in 69 patients with mild to moderate CF (FVC > 40%). However, Mellis noted improvements in *SF-36 total scores*; it is not clear in the abstract what was meant by this.

Blair et al. (1998) used the SF-36 to assess the psychological aspects of gene therapy in 16 patients with CF. The SF-36 scores in the domains of physical functioning, limitations of physical role, and general health were below that of the well reference group. There was a significant correlation between low mood and subjective health status, as measured by the SF-36.

In an abstract, Britto et al. (1999) used the SF-36 to determine the relationship between physical and psychosocial quality of life (QOL) and clinical disease severity measured by $FEV_1$, 6-minute walk distance, growth and pulmonary exacerbations. They found no significant associations between physical or psychosocial QOL scores and the variables, except pulmonary exacerbations that were associated with lower physical QOL (Britto et al, 1999).

Also in an abstract, Gee et al. (1999b) examined the validity and discriminatory ability of the SF-36 in a group of 225 CF adults. Their results showed that item to same domain correlations were higher than item to unrelated domain correlations. They found that the SF-36 demonstrated some discriminatory ability as a function of disease severity (Gee et al., 1999b).

In another abstract, Epker and Maddrey (1999) administered the SF-36 to 70 adult patients with CF. When compared with normal population scores, the scores from the total CF sample were indicative of more extensive limitations in each of the measured physical and emotional domains of the SF-36. They also found that female patients reported significantly greater impairment than did male patients (Epker and Maddrey, 1999).

### (L) SICKNESS IMPACT PROFILE (SIP) (de Jong et al., 1997)

The Sickness Impact Profile (SIP) contains 136 items grouped into 12 separate activity category scores. A physical dysfunction summary score is calculated from three categories (ambulation, mobility, body care and movement). A psychosocial dysfunction summary score is calculated from four categories (social interaction, communication, alertness, emotional behavior). All 12 category scores (the above-mentioned categories plus sleep and rest, eating, home management, recreational and pastime activities, employment) are combined to determine an overall behavioral dysfunction score. The scores represent a percentage of the maximum possible

dysfunction score, therefore, the higher the score, the worse the health state. (de Jong et al., 1997)

de Jong et al. (1997) used the SIP to evaluate the relationship between HRQOL and pulmonary function, exercise capacity, and dyspnea. Their results showed no relationship between HRQOL and pulmonary function ($FEV_1$, IVC), a significant negative relationship with exercise capacity, and a significant positive relationship with the dyspnea score (de Jong et al., 1997).

(M) OTHER HRQOL STUDIES IN PATIENTS WITH CF (Fuchs et al., 1994; Heijerman et al., 1995; Ramsey et al., 1993; Ranasinha et al., 1993; Shah et al., 1995; Wilmott et al., 1996)

Studies assessing the effect of rhDNase on HRQOL have been recently reported. Assessments of CF-related symptoms and overall well-being were included in the large phase III clinical trial of rhDNase (Fuchs et al., 1994). However, the instrument used to assess well-being and symptom control was not fully described by the authors. Several additional studies appear to have used the same unidentified HRQOL instrument (Ramsey et al., 1993; Ranasinha et al., 1993; Wilmott et al., 1996). It consisted of five questions about general well-being (feeling, energy, physical activity, appetite, sleep pattern) and four on CF-related symptoms (ease of sputum expectoration, cough frequency, cough severity, congestion). The answers were ranked on a five-point Likert scale. However, the reliability and validity of this measure have not been reported.

Results from the use of this particular questionnaire have been divided. Fuchs et al. (1994) found that patients receiving rhDNase once daily reported a small improvement in well-being over baseline compared to patients receiving placebo; patients receiving twice daily rhDNase did not differ from placebo-treated patients. Patients receiving rhDNase in both groups reported significant improvements in CF-related symptoms when compared to the placebo group. Wilmott et al. (1996), on the other hand, found no difference in HRQOL scores between the placebo and rhDNase treatment groups in the amount of improvement in cough and congestion, dyspnea at different levels of effort, activity limitation, emotional well-being, fatigue, days of restriction to bed, or general health perceptions. Ramsey et al. (1993) found that the frequency and magnitude of improvement (from baseline to Day 10) across all HRQOL questions was consistently greater among the patients receiving rhDNase than those receiving placebo. Ranasinha et al. (1993) found that administration of rhDNase did not improve overall HRQOL, but there were significant improvements for rhDNase in individual components (general well-being, cough frequency, chest congestion).

Heijerman et al. (1995) used a different unidentified questionnaire that contained six questions, with responses placed on a visual analog scale, in the following areas: patients awareness of expectoration, chest congestion, tenacious

sputum, exercise tolerance, physical handicap, and general well-being. They found that, for 12 adults with moderate to severe CF, treatment with rhDNase (2.5mg daily for six weeks) significantly improved the CF-related symptoms (perception of expectoration, airway congestion, and tenacious sputum) (Heijerman et al., 1995). However, there were no significant improvements in general well-being, exercise tolerance, or physical limitations reported by these patients.

Shah et al. (1995) used yet another unidentified HRQOL questionnaire that covered eight domains: cough, congestion, dyspnea, physical functioning, emotional well-being, fatigue, staying in bed, and general health perception. They found a non-statistically significant improvement in the HRQOL score in patients receiving rhDNase twice daily (Shah et al., 1995).

## 7. CF-Specific Health-Related Quality of Life

To increase the sensitivity to detect subtle changes in the symptomatology of the disease under study, it is generally suggested to also include a disease-specific HRQOL measure (Tullis and Guyatt, 1995; CCOHTA, 1997). Early literature in the area of CF indicated that no CF-specific HRQOL measures existed. However, because the predominant morbidity in CF is related to pulmonary disease, respiratory disease specific measures have occasionally been used.

The Chronic Respiratory Disease Questionnaire (CRDQ) has been used to assess HRQOL in people with CF. It is not a generic HRQOL questionnaire, but a condition-specific HRQOL instrument to measure HRQOL in respiratory diseases. The CRDQ measures change in dyspnea, fatigue, emotion, and mastery (i.e. control over the disease and its consequences). It is often used in groups with chronic lung disease and has been used before in CF populations to assess HRQOL (Wolter et al., 1997).

Wolter et al. (1997) used the CRDQ to assess the effect of home intravenous antibiotic therapy on HRQOL in adults with CF. Overall, there were significant changes from pre- to post-treatment in all four areas (dyspnea, fatigue, emotion, and mastery). The changes were of similar magnitude for both the home and hospital groups in the areas of dyspnea and emotional scores. Hospital patients had better scores for fatigue, mastery, and total scores, while home patients had better scores for family personal, sleep, and total disruption. In another study, Weir et al. (1991) described their use of the CRDQ to assess HRQOL in 51 patients with CF. Correlations to $FEV_1$ were weak for all four dimensions of the questionnaire.

With respect to CF-specific HRQOL instruments, there are no well-established and well-tested instruments available, but there appear to be several instruments under development. Discussions with colleagues and other researchers in this area have indicated that there are currently several different groups developing CF-specific instruments. One instrument is being developed by researchers in Toronto,

and is specifically for adult patients with CF (personal communication, Dr. Elizabeth Tullis, CF QOL Workshop, Seattle, Oct. 13, 1999). In an abstract, Tullis et al. (1999) discussed the initial stages of their instrument development. They have identified 118 items which were categorized into domains of physical, emotional, social, vocational, treatment related issues, and daily activities (Tullis et al., 1999). Pretesting and testing of validity, reliability, and responsiveness of this instrument are planned.

A second instrument is the Cystic Fibrosis Symptom Index for Adults. It has been developed and is being tested by researchers in Halifax (personal communication, Dr. David Haase, CF QOL Workshop, Seattle, Oct. 13, 1999). The two-page instrument consists of 20 items rated on scales of 1 to 10. It covers areas such as depression/anxiety, chest symptoms, appetite, sleep, socialization, and daily activities. No information is yet available on instrument testing or psychometric properties.

A third instrument being developed is the Australian CF QOL (Adults) and (Children) (CF QOL Workshop, Seattle, Oct. 13, 1999). The first part of the questionnaire consists of questions from the SF-36 and the second part has CF-specific questions dealing with shortness of breath, coughing, and pain/fever. The Child version is parent-administered. No published information is available with regard to its measurement properties.

An abstract by Gee et al. (1999a) described the development of the Cystic Fibrosis Quality of Life (CFQoL) Questionnaire by their group in the UK. The CFQoL comprises 52 items in 9 CF-specific domains; physical functioning, social functioning, treatment issues, chest symptoms, emotional responses, body image, interpersonal relationships, career concerns, concerns for the future, plus four general health questions. It has been tested for internal consistency reliability, test-retest reliability, discrimination, sensitivity, and concurrent validity (Gee et al., 1999a).

The CF Quality of Life Group in France has recently developed a French HRQOL instrument called the Cystic Fibrosis Questionnaire (CFQ). There are three versions: a parent form for children aged 8-13 (CFQ-Child P), a child form for ages 8-13 (CFQ-Child C), and a self-completed form for teenagers and adults (CFQ-14+) (Henry et al., 1997; Henry et al., 1998a; Henry et al., 1998b). Initial testing for validity and reliability has been done (Henry et al., 1997). The questionnaires have been translated to German and Spanish, with pilot tests run for each (Henry et al., 1998b).

The three versions of the CFQ have recently been translated for use in the U.S. and plans are currently underway to conduct further psychometric testing of the CFQ versions at multiple sites in the US (Quittner et al., 1998; Quittner et al., 1999b). It has been estimated that the U.S.-English translation of the CFQ will be available for use in early 2000 (personal communication, Esther Tan, CF QOL Workshop, Seattle, Oct. 13, 1999).

The Cystic Fibrosis Quality of Life Scale (CF-12) was used to assess attributes and HRQOL (Blair et al., 1998). Patients were asked, for the past two weeks, if they were short of breath, had a cough, needed to rest, had trouble bringing up their sputum, felt weak, lacked appetite, had abdominal pain, if doing CF treatment had interfered with their daily activities, had been constipated, had diarrhea, were tired, if breathlessness interfered with daily activities. All 12 questions are scored on a four-point scale: not at all, a little, quite a bit, or very much.

Blair et al. (1998) used the Cystic Fibrosis Quality of Life Scale (CF-12) to assess the psychological aspects of gene therapy in 16 patients with CF. The scores will be used as reference data for future comparisons with other CF groups. In conjunction with the CF-12, they used the SF-36, as discussed above. Both instruments demonstrated face validity, but need further testing to determine if they are sensitive measures of HRQOL in CF.

## 8. SUMMARY

CF is a genetic disease affecting approximately one in every 2,500 live births, with one in 25 being carriers of the defective gene. The basic defect in CF is abnormal chloride ion transport, which results in increased viscosity of mucus secretions. Because chloride ion channels are so widespread in the body, the physiologic impact of CF affects numerous systems. Pulmonary disease is primarily responsible for the morbidity and mortality in patients with CF. Other systems affected by the defective gene include the digestive, musculoskeletal, and reproductive systems. CF is quite variable with respect to both the systems involved and the severity of the symptoms.

HRQOL is measured using both generic and disease-specific instruments. Generic instruments are used to assess and compare HRQOL in various diseases or conditions, while disease-specific measures are used to assess HRQOL within only that disease. Generic instruments allow for comparisons between different patient groups or diseases, but are considered less responsive to changes in health. Disease-specific instruments, on the other hand, are more likely to detect smaller, but important, changes in patients with a condition or disease. CF has been assessed using various generic instruments for both adults and children. Recently CF-specific instruments have been developed and are being tested in CF populations.

## III. METHODS

PURPOSE – The purpose of this study was to develop and test the measurement properties of a CF-specific HRQOL measure for both adults and adolescents with CF.

### 1. INSTRUMENT DEVELOPMENT

The following steps for instrument development were conducted: (i) specifying measurement goals, (ii) item generation, (iii) item reduction, and (iv) questionnaire formatting, (DeVellis, 1991; Juniper et al., 1996b). Before developing the instrument, the measurement goals for the instrument were established. This instrument was developed to assess HRQOL in people with CF. It would be used to assess all aspects of daily life, including symptoms, physical functioning, emotions, social roles, treatment burden, and worry. Ideally an instrument would be developed to be discriminatory and evaluative, but, for this study, it was planned to initially assess the properties of this instrument as a discriminative measure.

#### (A) ITEM GENERATION

Item generation involved reviewing the current literature on CF to identify areas of importance in terms of the impact of the disease and treatments on health status and HRQOL. The content areas identified in the literature were reviewed by the physicians, nurses, dietitians, and physiotherapists from three CF clinics in Alberta (one adult and two pediatric clinics) who treat patients with CF to determine if the selected areas/issues really do affect the patients they treat. Additional areas that the clinicians found to be important were also included at this point.

This initial list of areas/issues was then adapted into a list of open-ended questions to be used in focus group discussions [Appendix I]. Focus groups were conducted for the two age groups: adolescents (aged 12-17 years) and adults (aged 18 and older). Attempts were made to recruit 6 to 8 patients who represented the full spectrum of patients with CF. The adult focus group involved 7 people from the Edmonton Adult CF Clinic. The two adolescent focus groups included 6 teens from Edmonton and 6 from Calgary (Edmonton and Calgary Pediatric CF Clinics). The individuals in the focus groups were asked to comment on the issues identified in the literature and by the clinicians, as well as to identify any other areas of impairment that were important to them at that time and, if adults, when they were children. The focus groups were moderated by a person trained in leading focus groups and were conducted in accordance with standard focus groups procedures (Krueger, 1996), including the use of consent forms [Appendix II].

The focus groups were audio-taped and then transcribed. The transcripts were then reviewed by two investigators to pull common themes from the focus group discussions. The themes were found to be similar for the adults and teens and, from there, a new set of items was developed. The themes that were identified included symptoms (pulmonary, gastro-intestinal, and pain), energy levels, treatment burden, worrying, and emotions. These items were formed into a questionnaire to be used for clinical impact testing [Appendix III].

### (B) CLINICAL IMPACT TESTING

The clinical impact method, rather than factor analysis, was used for item reduction, based on the discussion by Juniper et al. (1996b; 1997) and Fayers and Hand (1997). A clinical impact questionnaire [Appendix III] was mailed to all adults from the Edmonton Adult CF clinic and all teenagers from the Edmonton and Calgary Pediatric CF clinics. There were no identifiers on the questionnaires and, therefore, reminder phone calls could not be used to increase the response rates. Of the 76 questionnaires sent to the adults in Edmonton, 26 were returned, giving a response rate of 34%. Of the 36 questionnaires sent to the teens in Edmonton, 12 were returned, giving a response rate of 33%. Of the 33 questionnaires sent to the teens in Calgary, 16 were returned, giving a response rate of 48%. These response rates were considered normal since this was a mail survey with no reminder calls to increase the response rate. The results were considered to be representative of the populations surveyed.

For each item that appeared in the clinical impact questionnaire, frequency and importance were each scored on scales of 1 to 5. These two numbers were multiplied giving a clinical impact score. Within general groupings (e.g. symptoms, emotions, physical), the items were ranked according to their average clinical impact scores. The items with the lowest clinical impact scores were considered for removal. Discussions with the physicians and nurses indicated which items could be removed without losing important information from a clinical assessment perspective.

The items to be removed ended up being different for the adult and teen groups. For example, the "body image" questions were important to teens, but not as much to adults, whereas the "worry" questions were important to adults, but not as much to teens. At this point it was confirmed that two versions of the questionnaires would be developed: the Adult Cystic Fibrosis Quality of Life Questionnaire (ACFQ) and the Teen Cystic Fibrosis Quality of Life Questionnaire (TCFQ) [Appendix IV].

The remaining items were grouped into hypothesized domains (e.g. physical functioning, symptoms, and emotions) for both versions (ACFQ and TCFQ), keeping the similarities constant where possible. These domains were based on clinical experience as well as the domains found in existing instruments, such as the AQLQ (Juniper et al., 1993).

### (c) Questionnaire Formatting

The format of the questionnaires was based on existing HRQOL questionnaires, such as the ones designed and tested by Juniper et al. (1993; 1996a) in their work on asthma. The AQLQ and PAQLQ use a two-week response period, have coloured response option cards, and use a 7-point response option scale (Juniper et al., 1993; Juniper et al., 1996a).

#### (i) Item Stems

Within the established domains, the items were formed into groups of questions. The items were not kept strictly in their domains, but rather grouped according to the type of question they were. For example, the stem of a question might ask "How bothered have you been during the last two weeks by: ..." Then the remainder of the question would be "... coughing" or "... shortness of breath", etc..

There were also questions on how often something occurred. For example, "In general, how often during the last two weeks did you: ..." The remainder of the question might be "cough during the day" or "have difficulty taking a deep breath", etc., again with response options for each item [Appendix IV].

The recall time period used for the questions was two weeks, based on time periods used in existing instruments (Juniper et al. 1993). Other options considered were one week and four week recall periods. It was felt that two weeks was an appropriate amount of time for recall by patients.

#### (ii) Response Options

Five-point response options were indicated for each item. The general format was based on response options used in other established HRQOL instruments. The response options for the 'bother' questions were:

1) Extremely bothered
2) Quite bothered
3) Somewhat bothered
4) Hardly bothered
5) Not bothered

The response options for the 'how often' questions were:

1) All of the time
2) Most of the time
3) Some of the time
4) Hardly any of the time
5) None of the time

### (iii) General Health Rating Item

Along with the 'bother' and 'how often' questions, a general health rating (GH) question was included: "In general, would you say your health is: excellent, very good, good, fair, or poor." (Ware et al. 1993)

### (iv) Method of Administration

The ACFQ and TCFQ were developed to be either interviewer-administered or self-administered. The format of the questionnaires was the same for both forms, with the interviewer form including a spot to record the patient identification number, patient initials, and date. There were also three laminated colour-coded cards that accompanied the interviewer-administered form. For each question, the card was indicated on the form and the interviewer showed the respondent the corresponding coloured card with the response options typed on it. The yellow card had the 'excellent, very good, good, fair, poor' response options. The blue card had the 'bother' response options. The green card had the 'how often' response options.

## (D) Questionnaire Scoring

Individual items were scored using five-point response scales with appropriate response categories, as discussed above. Negatively worded items were reverse scored, so that the higher the HRQOL score, the better the health status. The questions were grouped into ten domains as follows:

| | | |
|---|---|---|
| 1. | general health | (GH) |
| 2. | symptoms – respiratory | (SX-R) |
| 3. | symptoms – GI | (SX-G) |
| 4. | symptoms – pain | (SX-P) |
| 5. | treatment burden | (TXB) |
| 6. | social role | (SR) |
| 7. | physical functioning | (PF) |
| 8. | worry – body image and awareness | (W-BIA) |
| 9. | worry – social interactions | (W-SI) |
| 10. | emotions | (EM) |

The domain-specific scores were calculated as summated scores for the items contained in that particular scale, and converted to a 0 to 100 scale of possible scores. The scales were pro-rated to be out of 100 using the following formula: [(raw score – minimum score) / (range) * 100]. Scoring guides for the ACFQ and TCFQ were developed [Appendix V].

The general health (GH) rating question responses are an ordinal scale. Responses to this item may be presented as categorical, or converted to an interval scale. The interval between 'excellent' and 'very good' has been shown to be about half the size of the interval between 'fair' and 'good' (Ware and Sherbourne, 1992). To provide an interval level scale, the following scale conversion, based on Thurstone Method of Equal-Appearing Intervals, was used (Ware et al., 1993).

| | | |
|---|---|---|
| Excellent | 5 (raw score) | 100 (on the 0-100 scale) |
| Very good | 4 (raw score) | 84 (on the 0-100 scale) |
| Good | 3 (raw score) | 61 (on the 0-100 scale) |
| Fair | 2 (raw score) | 25 (on the 0-100 scale) |
| Poor | 1 (raw score) | 0 (on the 0-100 scale) |

## 2. CLINICAL TESTING – MEASUREMENT PROPERTIES

### (A) PATIENT RECRUITMENT

For the clinical testing phase, patients were recruited from three CF clinics in Alberta. Adult patients were recruited from the Adult CF clinic in Edmonton (University of Alberta Hospital). Adolescent patients (aged 12 to 18) were recruited from the Pediatric clinics in Edmonton (University of Alberta Hospital) and Calgary (Alberta Children's Hospital). Patients who were acutely ill, based on clinical judgment, were excluded from the study. For the clinical testing, it was attempted to recruit 15 patients from each of the three clinics, for a total of 45 patients.

The justification for the number of patients recruited was based largely on practical considerations. Since this was a relatively small population, a judgment call was made to determine the sample size. The analysis plan was based largely on correlational analysis in which a large number of patients was not necessarily required.

Participation in this study did not entail any significant health risk. Ethics approval was granted for the project from both the University of Alberta / Capital Health Authority and the Alberta Children's Hospital / University of Calgary Ethics Review Boards.

### (B) DATA COLLECTION

Most of the data that was collected were clinical measures that were routinely collected at each clinic visit and, therefore, did not represent any additional burden for the patients. The six-minute walk-test and the administration of the questionnaires represented the additional time and effort required for the

participating patient. It was anticipated that this extra effort would require approximately 45 minutes of the patient's time beyond a normal clinic visit.

### (i) HRQOL Data

#### (a) ACFQ / TCFQ

Both the ACFQ and TCFQ were administered during face-to-face interviews to ensure complete data collection. Interviewers were trained before conducting the interviews mainly by sitting in on one or two interviews that were taking place. An interviewer guide to facilitate the interview process was developed [Appendix VI], based on the AQLQ and PAQLQ by Juniper et al. (1993; 1996a). The interviewers also administered the SF-12 and EQ-5D, since it is generally recommended to use both a disease-specific HRQOL instrument and a generic HRQOL instrument (CCOHTA, 1997). The disease-specific instrument would increase the sensitivity to detect subtle changes, while the generic instruments would add to the generalizability and the validity.

#### (b) EQ-5D

The EQ-5D is an example of a preference-based index measure, which provides a single number representing the overall HRQOL of an individual at a point in time and quantifies a preference for their health state (Kind, 1996). The EQ-5D descriptive system consists of five dimensions (Mobility, Self-Care, Usual Activities, Pain/Discomfort, Anxiety/Depression) with three levels each (no problem, some problems, extreme problems), thus defining 243 ($3^5$) distinct health states. The EQ-5D also includes a visual analogue scale (VAS) as a means of valuing the health state of the respondent, independent of the descriptive system. The endpoints of the VAS are labelled 'best imaginable health state' and 'worst imaginable health state', anchored at 100 and 0, respectively. Respondents are asked to indicate how they rate their health by drawing a line from an anchor box to the point on the VAS which best represents their own health that day. While it is considered an index measure, responses to the EQ-5D can be presented variously as a derived index score, a VAS score, and a profile of responses to the dimensions (Kind, 1996) [Appendix VII].

Overall index scores for the EQ-5D were calculated using the weighting system derived by Dolan at York University (Dolan, 1997). These weights were derived from the general population in the United Kingdom using time trade-off valuation interviews.

### (c) SF-12

In contrast to preference-based index measures, profile measures provide information on any number of sub-classifications, or dimensions, of HRQOL. The most commonly used health status profile measure is the SF-36 (Ware and Sherbourne, 1992). The SF-36 has been used to assess HRQOL in CF in the past (Blair et al., 1998; Johnson et al., 1999; Mellis, 1997). An abbreviated version of the SF-36 has been introduced which contains only 12 items (SF-12 Health Survey) (Ware et al., 1995b; Ware et al., 1996). Like the SF-36, summary scores for physical and mental health status can be derived from the SF-12, referred to as the Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12), respectively (Ware et al., 1995a). The summary scores of the SF-12 have also been shown to closely represent the summary scores of the SF-36 (Ware et al., 1994; Jenkinson and Layte, 1997). The PCS-12 and MCS-12 scores have also been found to be virtually identical to the SF-36 summary scores in indicating the level of health and sensitivity to change in studies of patient treatment groups with various conditions (Bessette et al., 1998; Jenkinson et al., 1997). Because it is 12 questions rather than 36, the administration time is shorter and, therefore, the patient burden is reduced [Appendix VIII].

Scoring for the PCS-12 and MCS-12 of the SF-12 Health Survey was performed using the SAS scoring program from the New England Medical Center (Ware et al., 1995b; Ware et al., 1996).

## (ii) CLINICAL DATA

The Clinic Data Abstraction Form was completed by the CF Clinic nurses [Appendix IX]. Based on a review of the literature, from both clinical and HRQOL studies, the following clinical variables were collected:

1) if sick at time of visit
2) weight and height
3) spirometry scores: $FEV_1$, $FEF_{25-75}$, FVC
4) drug therapies at time of visit: rhDNase, antibiotics, oxygen, enzymes
5) microbacterial status: *P. aeruginosa*, *B. cepacia*, *S. aureus*

BMI was calculated as weight (in Kg) over height (in m) squared ($W / H^2$). A severity score was calculated from the $FEV_1$ score as follows: mild ($\%FEV_1 \geq 70$), moderate ($40 \leq \% FEV_1 < 70$), and severe ($\%FEV_1 < 40$). This classification was the standard for the Epidemiologic Study of CF (ESCF).

The six-minute walking endurance test was conducted by the physiotherapist at each clinic. The total distance walked was recorded as a functional measure of

endurance. Pre and post oxygen ($O_2$) saturation was also measured. Standard encouragement was given during walking, as per the protocol (Guyatt et al, 1984).

Finally, the modified NIH Clinical Severity Score (Sockrider et al., 1994) was calculated by the physicians to give a measure of disease progression, with higher scores indicating better health. 75 of the possible 100 points were for pulmonary function, while the remaining 25 points were for general condition [Appendix X].

#### (iii) Demographic Data

The interviewer also collected the demographic information at the time of the HRQOL interview. It consisted of gender, age, number of hospital admissions in the past year, living arrangements (alone, with parents, with spouse, with others), work or student. Adults were also asked if they have children, their level of education, and their household income [Appendix XI].

### (c) Statistical Analysis

#### (i) Reliability

The reliability of a measure indicates the degree to which the scores represent the "true" HRQOL, that is the ratio of "signal" to "noise" in the measurement. Reliability in this investigation was assessed in terms of internal consistency. Internal consistency of the questionnaire responses was assessed using Cronbach's $\alpha$ coefficient, which represents the average of the correlations among all the items in the measure (Cronbach, 1951). Cronbach's $\alpha$ is calculated to determine whether the separate items within the subdomains measure the same construct. A high value indicates a high level of homogeneity of the items within that scale. An $\alpha$ coefficient exceeding 0.70 is considered an acceptable level of reliability for between groups comparison, although some authors indicate lower levels may still be acceptable (Hays et al., 1993).

#### (ii) Validity

Validity of an instrument indicates the degree to which it actually measures what it purports to measure. In this investigation, content and construct validity were assessed. Content validity was established in the focus groups and in the review of the items by clinic staff, as well as in the clinical impact scoring. Construct validity was established by comparing the scores generated by the new instruments to

existing measures of health status in CF patients, including clinical measures and HRQOL scores from the generic HRQOL instruments.

The general hypothesis underlying the validity testing was that the HRQOL scores would have moderate to strong correlations with clinical measures of functional status and with scores from generic HRQOL instruments. One approach considers correlations to be strong if they are greater than 0.5, moderate if they are 0.35 to 0.5, and poorly correlated if they are between 0.2 and 0.34 (Juniper et al., 1996b). Another approach considers a large effect to be over 0.5, a medium effect to be between 0.3 and 0.5, and a small effect to be between 0.1 and 0.3 (Cohen, 1988).

### (a) HYPOTHESES

To strengthen the results of the construct validation exercise, the hypothesized relationships, including direction (positive or negative) and magnitude (weak, moderate, and strong) should be stated *a priori*. For the purposes of this study, the convention of Cohen (1988) was adopted for strength of relationship. Prior to the data analysis, consensus among three members of the research group for the hypothesized relationships were made. Not every relationship was hypothesized, but only those stated in Tables 3.1 and 3.2.

**TABLE 3.1** – HYPOTHESIZED CORRELATIONS BETWEEN ACFQ/TCFQ SCORES AND CLINICAL VARIABLES

| | BMI | $FEV_1$ | Walk test | NIH |
|---|---|---|---|---|
| GH | +, w/m | +, m | +, m/s | +, m |
| PF | +, m | +, s | +, s | +, m |
| SX-R | +, w/m | +, s | +, m/s | +, s |
| SX-G | +, m | | | +, m |
| SX-P | | +, m | +, m | +, m |
| TXB | | +, m | +, m | +, m |
| SR | | +, w | | +, w |
| W-BIA | | | | |
| W-SI | | | | |
| EM | | | | |

+ = positive correlation, - = negative correlation, w = weak, m = moderate, s = strong

BMI is an indicator of health, with healthier people having a BMI score within a certain range. Since people with CF have difficulty gaining weight, it was assumed that their BMI scores would fall below (rather than above) the optimal range. Therefore, it was hypothesized that the general health (GH) and respiratory symptom (SX-R) scores would be positively, weakly to moderately correlated with BMI scores. It was also hypothesized that physical function (PF) and GI symptom scores (SX-G) would be positively, moderately correlated with BMI scores. This has been supported in the literature, with both Congleton et al. (1996) and Johnson et al. (1999) finding statistically significantly positive correlations between BMI scores and HRQOL scores.

$FEV_1$ is often used as a measure of lung functioning in the CF population. It is reported as a percent of predicted, adjusted for age, gender, and ethnicity, with higher $FEV_1$ values indicating better lung functioning. It was hypothesized that the physical function (PF) and respiratory symptom (SX-R) scores would be positively, strongly correlated with $FEV_1$. It was hypothesized that the general health (GH), pain symptom (SX-P), and treatment burden (TXB) scores would be positively, moderately correlated with $FEV_1$. It was also hypothesized that the social role (SR) score would be positively, weakly correlated with $FEV_1$. The literature has indicated a positive relationship, in the moderate range (Orenstein et al., 1989; Orenstein et al., 1990; Munzenberger et al. 1999; Powers, 1998; Congleton et al., 1996; Johnson et al., 1999).

Similarly, the distance walked on the six-minute walk test is an indicator of the functional capacity of these patients; limited endurance would be expected to have a negative impact on HRQOL. Therefore, a positive and strong correlation was expected between the physical functioning (PF) score and the walk test results. It was hypothesized that the general health (GH) and respiratory symptom (SX-R) scores would be positively, moderately to strongly correlated with the walk test results. It was also hypothesized that pain symptoms (SX-P) and treatment burden (TXB) would be positively, moderately correlated with the walk test results.

The NIH score is used as an index of severity in CF, and was expected to be positively, strongly correlated with the respiratory symptoms (SX-R) scores. It was hypothesized that the general health (GH), physical function (PF), GI symptom (SX-G), pain symptoms (SX-P), and treatment burden (TXB) scores would be positively, moderately correlated with the NIH scores. It was also hypothesized that social role (SR) scores would be positively, weakly correlated with the NIH scores. Higher scores indicate less severe disease, and therefore a positive correlation was expected with the HRQOL scores, as has been previously reported in the literature (Czyzewski et al., 1994; Czyzewski and Bartholomew, 1998).

**TABLE 3.2 – HYPOTHESIZED CORRELATIONS BETWEEN ACFQ/TCFQ SCORES AND SF-12 / EQ-5D SCORES**

| | SF-12 | | EQ-5D | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | PCS | MCS | MOB | SC | UA | P/D | A/D | Index | VAS |
| GH | +, m/s | +, m | -, s | -, m | -, m/s | -, m | -, m | +, s | +, s |
| PF | +, s | | -, s | -, s | -, m | | | +, s | +, s |
| SX-R | +, m/s | | -, m | | | -, m | | +, s | +, s |
| SX-G | +, m/s | | -, m | | | -, m | | +, s | +, s |
| SX-P | +, m | | -, m | | | -, s | | +, s | +, s |
| TXB | +, m | +, m | | -, m/s | -, m | | -, w | +, m | +, m |
| SR | +, m | +, m | | | -, m/s | | | +, m | +, m |
| W-BIA | | +, m/s | | | | | -, m/s | +, m | +, m |
| W-SI | | +, m/s | | | | | -, m/s | +, m | +, m |
| EM | | +, s | | | | | -, s | +, m | +, m |

+ = positive correlation, - = negative correlation, w = weak, m = moderate, s = strong

It was also hypothesized how the HRQOL scores from the ACFQ and TCFQ would be correlated with the HRQOL scores obtained on the standardized, generic instruments (SF-12 and EQ-5D) for the particular age groups. As the PCS-12, MCS-12, EQ-5D Index, and EQ-VAS are summated such that higher scores indicated better functioning and better HRQOL, positive correlations were hypothesized. The individual dimensions from the EQ-5D (MOB, SC, UA, P/D, and A/D) have categorical response options indicating worse health at a higher number. Because a higher number means worse health, there exists an inverse relationship between these scores, thus leading the hypotheses to be in a negative direction.

For the SF-12, it was expected that the more physical or symptom-related scores would be positively correlated with the PCS-12, while the worry and emotion scores would be positively correlated with the MCS-12. It was hypothesized that general health (GH), physical function (PF), respiratory symptoms (SX-R), GI symptoms (SX-G), pain symptoms (SX-P), treatment burden (TXB), and social role (SR) would be positively, moderately to strongly (as indicated) correlated with the PCS-12 scores. It was hypothesized that general health (GH), treatment burden (TXB), social role (SR), worry body image and awareness (W-BIA), worry social interactions (W-SI), and emotions (EM) would be positively, moderately to strongly (as indicated) correlated with the MCS-12 scores.

For the EQ-5D, it was hypothesized that mobility (MOB) would be negatively, strongly correlated with general health (GH) and physical function (PF), and

negatively, moderately correlated with the three symptom areas (SX-R, SX-G, SX-P). It was hypothesized that self-care (SC) would be negatively, strongly to moderately correlated with general health (GH), physical function (PF), and treatment burden (TXB). Usual activities (UA) were hypothesized to be negatively, strongly to moderately correlated with general health (GH), physical function (PF), treatment burden (TXB), and social role (SR). Pain and discomfort (P/D) were hypothesized to be negatively, strongly correlated with pain symptoms (SX-P) and negatively, moderately correlated with general health (GH) and respiratory and GI symptoms (SX-R, SX-G). Anxiety and depression (A/D) were hypothesized to be negatively, strongly to moderately correlated with general health (GH), worry (W-BIA, W-SI) and emotions (EM), and weakly correlated with treatment burden (TXB).

The EQ-5D Index and VAS scores were hypothesized to have similar relationships with the ACFQ and TCFQ domains. They were hypothesized to be positively, strongly correlated with general health (GH), physical function (PF), and the symptoms (SX-R, SX-G, SX-P). They were hypothesized to be positively, moderately correlated with treatment burden (TXB), social role (SR), worry (W-BIA, W-SI), and emotions (EM).

### (b) Data Analysis

Statistical techniques were used to assess the relationships between the ACFQ / TCFQ scores and the clinical variables, as well as the generic HRQOL scores. Correlation coefficients were calculated for the pairs of variables. For two continuous variables, the Pearson product moment correlation coefficient was calculated (Kachigan, 1986). The majority of the correlations used the Pearson product moment coefficent: BMI, $FEV_1$, walk test, NIH score, PCS-12, MCS-12, EQ-5D Index, and EQ-VAS. For the EQ-5D variables that were categorical (MOB, SC, UA, P/D, and A/D), Spearman rank correlations were calculated.

## IV. RESULTS – CLINICAL TESTING

### 1. PATIENT DESCRIPTION

The adult sample was recruited from the Adult CF Clinic in Edmonton. Fifteen patients participated in the clinical testing portion of the study, of whom six (40%) were men. The age range of the group was 20 to 61 years old, with an average age of 32. They had been admitted to a hospital between 0 and 3 times in the previous year, with an average of 0.6 times. As a group, their average level of education was a high school diploma and their average household income was in the $25,000 to $50,000 range.

The adolescent population was recruited from the Pediatric CF Clinics in Edmonton and Calgary. Fifteen patients from Edmonton and fourteen from Calgary participated in the clinical testing portion of the study, of whom 15 (52%) were male. The age range of the group was 12 to 18 years old, with an average age of 15. They had been admitted to a hospital between 0 and 5 times in the previous year, with an average of 0.9 times. Education level and household income were not collected from the teens.

**TABLE 4.1** – DEMOGRAPHIC STATISTICS

| | ADULTS (N=15) | ADOLESCENTS (N=29) |
|---|---|---|
| GENDER | 6 MALES; 9 FEMALES | 15 MALES; 14 FEMALES |
| AGE RANGE (YEARS) | 20 – 61 | 12 – 18 |
| AVERAGE AGE (YEARS) | 31.5 (SD 11.4) | 14.5 (SD 1.6) |
| HOSPITALIZATION RANGE | 0 – 3 TIMES | 0 – 5 TIMES |
| AVERAGE HOSPITALIZATIONS IN THE PAST YEAR | 0.60 TIMES / PERSON (SD 1.0) | 0.86 TIMES / PERSON (SD 1.4) |

### 2. HRQOL DESCRIPTION

#### (A) ACFQ

The descriptive statistics for the ten scales of the ACFQ are presented in Table 4.2. The lowest average score was in the physical function (PF) scale at 57.3, and the highest average score was on the social role (SR) scale at 85.0. Individual variation

can be seen in the range of scores. The general health (GH) score, for example, ranges from 0 to 100. The second highest range was found in respiratory symptoms (SX-R), where the lowest score was 17.5 and the highest was 87.5.

The ceiling effect was seen in several of the domains, which were scored at the maximum score of 100. For general health (GH), treatment burden (TXB), and social role (SR), seven percent (one respondent) scored 100. For pain symptoms (SX-P) and worry – social interactions (W-SI), 13 percent (two respondents) scored 100. For GI symptoms (SX-G) and worry – body image and awareness (W-BIA), 20 percent (three respondents) scored 100.

**TABLE 4.2** – ACFQ STATISTICS (N=15)

| | # of Items | Minimum | Maximum | % at Max. | Mean | St. Dev. |
|---|---|---|---|---|---|---|
| GH | 1 | 0.0 | 100.0 | 7% | 58.5 | 28.2 |
| PF | 11 | 25.0 | 88.6 | 0% | 57.3 | 18.4 |
| SX-R | 10 | 17.5 | 87.5 | 0% | 62.3 | 20.0 |
| SX-G | 5 | 60.0 | 100.0 | 20% | 84.0 | 13.7 |
| SX-P | 4 | 37.5 | 100.0 | 13% | 67.9 | 21.1 |
| TXB | 7 | 60.7 | 100.0 | 7% | 80.0 | 11.2 |
| SR | 5 | 55.0 | 100.0 | 7% | 85.0 | 12.0 |
| W-BIA | 4 | 50.0 | 100.0 | 20% | 75.4 | 18.1 |
| W-SI | 5 | 45.0 | 100.0 | 13% | 75.3 | 16.8 |
| EM | 11 | 59.0 | 95.5 | 0% | 76.7 | 8.8 |

The inter-scale correlation coefficients for the ACFQ are presented in Table 4.3. Four pairs of scales were statistically significantly correlated with a strong magnitude of correlation ($\geq 0.5$): (1) general health (GH) and respiratory symptoms (SX-R), (2) respiratory symptoms (SX-R) and treatment burden (TXB), (3) respiratory symptoms (SX-R) and physical function (PF), and (4) treatment burden (TXB) and physical function (PF).

**TABLE 4.3 – ACFQ INTER-SCALE CORRELATION COEFFICIENTS (N=15)**

| | GH | PF | SX-R | SX-G | SX-P | TXB | SR | W-BIA | W-SI | EM |
|---|---|---|---|---|---|---|---|---|---|---|
| GH | 1.0 | | | | | | | | | |
| PF | 0.51 | 1.0 | | | | | | | | |
| SX-R | 0.64* | 0.65** | 1.0 | | | | | | | |
| SX-G | -0.01 | -0.04 | 0.11 | 1.0 | | | | | | |
| SX-P | 0.49 | 0.32 | 0.28 | 0.34 | 1.0 | | | | | |
| TXB | 0.11 | 0.72** | 0.52* | -0.08 | 0.05 | 1.0 | | | | |
| SR | 0.12 | 0.51 | 0.34 | -0.19 | 0.04 | 0.43 | 1.0 | | | |
| W-BIA | 0.21 | 0.19 | 0.16 | -0.08 | 0.46 | 0.01 | -0.16 | 1.0 | | |
| W-SI | 0.08 | 0.12 | -0.14 | -0.36 | 0.28 | 0.19 | 0.26 | 0.22 | 1.0 | |
| EM | -0.14 | 0.12 | -0.29 | 0.28 | 0.05 | 0.06 | 0.20 | 0.17 | 0.16 | 1.0 |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

### (B) TCFQ

The descriptive statistics for the ten scales of the TCFQ are presented in Table 4.4. The lowest average score was for worry about body image / awareness (W-BIA) at 73.4, and the highest average score was on the social role (SR) scale at 89.5. Individual variation can be seen in the range of scores. The general health (GH) score, for example, ranged from 0 to 100. The second highest range was found in worry about body image / awareness (W-BIA), where the lowest score was 29.2 and the highest was 100.0.

In every domain but one (SX-R), the highest score was 100, which is the maximum possible, indicating good health. The ceiling effect was seen more prominently in the TCFQ than the ACFQ. For emotions (EM), three percent (one respondent) scored 100. For treatment burden (TXB), seven percent (two respondents) scored 100. For physical function (PF), ten percent (3 respondents) scored 100. For social role (SR) and worry – body image / awareness (W-BIA), 14 percent (4 respondents) scored 100. For worry – social interactions (W-SI), 17 percent (5 respondents) scored 100. For GI symptoms (SX-G), 21 percent (6 respondents) scored 100. For general health (GH) and pain symptoms (SX-P), 33 percent (7 respondents) scored 100.

**TABLE 4.4** – TCFQ STATISTICS (N=29)

| | # of Items | Minimum | Maximum | % at Max. | Mean | St. Dev. |
|---|---|---|---|---|---|---|
| GH | 1 | 0.0 | 100.0 | 33% | 75.0 | 23.4 |
| PF | 9 | 33.3 | 100.0 | 10% | 74.3 | 19.7 |
| SX-R | 10 | 37.5 | 97.5 | 0% | 79.8 | 14.7 |
| SX-G | 5 | 60.0 | 100.0 | 21% | 85.9 | 12.0 |
| SX-P | 4 | 43.8 | 100.0 | 33% | 87.1 | 12.2 |
| TXB | 6 | 41.7 | 100.0 | 7% | 76.7 | 16.6 |
| SR | 7 | 67.9 | 100.0 | 14% | 89.5 | 8.3 |
| W-BIA | 6 | 29.2 | 100.0 | 14% | 73.4 | 19.6 |
| W-SI | 5 | 40.0 | 100.0 | 17% | 85.9 | 14.4 |
| EM | 11 | 50.0 | 100.0 | 3% | 77.2 | 12.0 |

The inter-scale correlation coefficients for the TCFQ are presented in Table 4.5. Nine pairs of scales are statistically significantly correlated with a strong magnitude of correlation ($r \geq 0.5$): (1) general health (GH) and respiratory symptoms (SX-R), (2) general health (GH) and physical function (PF), (3) respiratory symptoms (SX-R) and physical function (PF), (4) respiratory symptoms (SX-R) and emotions (EM), (5) GI symptoms (SX-G) and treatment burden (TXB), (6) treatment burden (TXB) and emotions (EM), (7) social role (SR) and physical function (PF), and (8) physical function (PF) and emotions (EM).

**TABLE 4.5** – TCFQ INTER-SCALE CORRELATION COEFFICIENTS (N=29)

| | GH | PF | SX-R | SX-G | SX-P | TXB | SR | W-BIA | W-SI | EM |
|---|---|---|---|---|---|---|---|---|---|---|
| GH | 1.0 | | | | | | | | | |
| PF | 0.58** | 1.0 | | | | | | | | |
| SX-R | 0.76** | 0.60** | 1.0 | | | | | | | |
| SX-G | 0.17 | 0.40* | 0.22 | 1.0 | | | | | | |
| SX-P | 0.13 | 0.32 | 0.20 | -0.03 | 1.0 | | | | | |
| TXB | 0.30 | 0.29 | 0.22 | 0.52** | 0.15 | 1.0 | | | | |
| SR | 0.33 | 0.61** | 0.26 | 0.36 | 0.34 | 0.32 | 1.0 | | | |
| W-BIA | 0.09 | 0.15 | -0.03 | 0.15 | 0.18 | 0.34 | 0.17 | 1.0 | | |
| W-SI | 0.20 | 0.28 | 0.11 | -0.18 | 0.40* | 0.24 | 0.34 | 0.35 | 1.0 | |
| EM | 0.48** | 0.63** | 0.58** | 0.30 | 0.37 | 0.51** | 0.26 | 0.33 | 0.43* | 1.0 |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

Four pairs of scales are statistically significantly correlated with a moderate magnitude of correlation ($0.3 \leq r < 0.5$): (1) general health (GH) and emotions (EM), (2) GI symptoms (SX-G) and physical function (PF), (3) pain symptoms (SX-P) and worry about social interaction (W-SI), and (4) worry about social interactions (W-SI) and emotions (EM).

(c) EQ-5D

The EQ-5D scores are presented in Tables 4.6 and 4.7, as well as Figures 4.1 and 4.2 for adults and teens respectively. The tables show the results for the EQ-VAS (0 to 100) and Index (0 to 1) scores, which are both overall ratings of health. The ranges and means were slightly lower for the adults, although the mean score for the Index was the same for both groups.

**TABLE 4.6** – ADULT EQ-5D SCORES (N=15)

| | Minimum | Maximum | Mean | St. Deviation |
|---|---|---|---|---|
| VAS | 40 | 95 | 73.67 | 13.82 |
| INDEX | 0.16 | 1.00 | 0.83 | 0.22 |

**FIGURE 4.1** – ADULT EQ-5D SCORES (N=15)

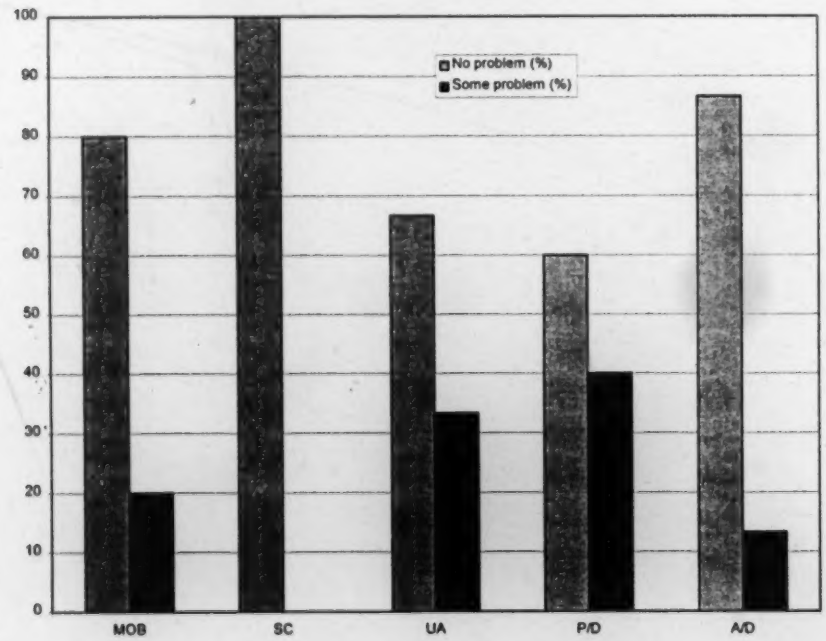
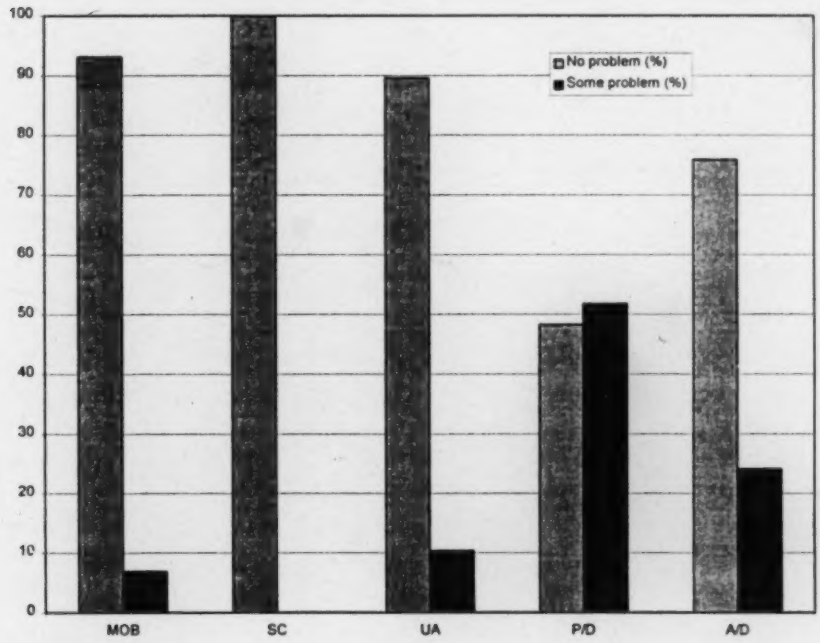


**TABLE 4.7** – TEEN EQ-5D SCORES (N=29)

| | Minimum | Maximum | Mean | St. Deviation |
|---|---|---|---|---|
| VAS | 45 | 100 | 78.14 | 15.08 |
| INDEX | 0.26 | 1.00 | 0.83 | 0.18 |

The bar charts in Figures 4.1 and 4.2 show the results for the EQ-5D dimensions (MOB, SC, UA, P/D, A/D), which are categorical on scales of 1 to 3. The results are presented as either having no problem (response 1) or some problem (which combines responses 2 and 3). The results indicated that both groups have 'no problem' in self care (SC), but 'some' or 'extreme' problems in the other domains.

**FIGURE 4.2** – TEEN EQ-5D SCORES (N=29)




(D) SF-12

The SF-12 scores are presented in Table 4.8 for both adults and teens. The range of the scores once again indicated the individual differences between patients. The MCS scores were found to be similar for the teens and adults, while the PCS scores were lower for the adults.

**TABLE 4.8** – SF-12 SCORES (ADULT N=15; TEENS N=29)

| | Minimum | Maximum | Mean | St. Deviation |
|---|---|---|---|---|
| PCS-12 – Adult | 26.21 | 59.58 | 42.57 | 10.57 |
| PCS-12 – Teen | 28.60 | 58.79 | 51.21 | 6.56 |
| MCS-12 – Adult | 36.13 | 63.80 | 53.55 | 7.90 |
| MCS-12 – Teen | 31.38 | 61.22 | 52.98 | 8.20 |

3. CLINICAL DESCRIPTION

(A) ADULTS

The clinical variables that were collected included: weight, height, BMI, whether sick at the time of the visit, drug use at the time of the visit (rhDNase, antibiotics, oxygen, enzyme, other drugs), $FEV_1$ score, FVC score, $FEF_{25-75}$ score, severity index, walk test score, NIH score, and the presence of bacteria (*P. aeruginosa*, *B. cepacia*, *S. aureus*, other). The descriptive statistics on the continuous variables are presented in Table 4.9 and the categorical variables in Table 4.10.

**TABLE 4.9** – ADULT CLINICAL STATISTICS (CONTINUOUS VARIABLES) (N=15)

| | Minimum | Maximum | Mean | St. Deviation |
|---|---|---|---|---|
| Weight (kg) | 40 | 87 | 59.11 | 13.69 |
| Height (cm) | 152 | 186 | 164.21 | 10.09 |
| BMI | 16.83 | 30 | 21.80 | 4.03 |
| $FEV_1$ (%) | 15 | 93 | 49.13 | 25.98 |
| FVC (%) | 34 | 103 | 67.80 | 21.47 |
| $FEF_{25-75}$ | 4 | 94 | 28.27 | 26387 |
| Walk test (m) | 375 | 786 | 527.27 | 99.21 |
| NIH score (0-100) | 51 | 95 | 68.80 | 13.84 |

**TABLE 4.10** – ADULT CLINICAL STATISTICS (CATEGORICAL VARIABLES) (N=15)

| | Percent |
|---|---|
| Sick at time of visit | 33% |
| rhDNase | 73% |
| Antibiotics | 47% |
| Oxygen | 0% |
| Enzyme | 73% |
| Other drugs | 53% |
| Mild severity (%$FEV_1 \geq 70$) | 20% |
| Moderate severity ($40 \leq$ %$FEV_1 < 70$) | 33% |
| Severe severity (%$FEV_1 < 40$) | 47% |
| *P. aeruginosa* | 60% |
| *B. cepacia* | 13% |
| *S. aureus* | 33% |
| Other bacteria | 20% |

(B) TEENS

**TABLE 4.11** – TEEN CLINICAL STATISTICS (CONTINUOUS VARIABLES) (N=29)

| | Minimum | Maximum | Mean | St. Deviation |
|---|---|---|---|---|
| Weight (kg) | 36.80 | 74.80 | 50.66 | 10.93 |
| Height (cm) | 144.20 | 176.40 | 161.15 | 9.62 |
| BMI | 15.73 | 25.73 | 19.32 | 2.61 |
| $FEV_1$ (%) | 27 | 130 | 79.90 | 24.61 |
| FVC (%) | 37 | 137 | 95.69 | 24.03 |
| $FEF_{25-75}$ | 10 | 110 | 58.21 | 30.43 |
| Walk test (m) | 350 | 665 | 523.59 | 73.25 |
| NIH score (0-100) | 40 | 95 | 80.03 | 15.17 |

The same clinical variables were collected for teens as adults. They included: weight, height, BMI, whether sick at the time of the visit, drug use at the time of the

visit (rhDNase, antibiotics, oxygen, enzyme, other drugs), $FEV_1$ score, FVC score, $FEF_{25-75}$ score, severity index, walk test score, NIH score, and the presence of bacteria (*P. aeruginosa*, *B. cepacia*, *S. aureus*, other). The descriptive statistics on these variables are presented in Tables 4.11 and 4.12.

**TABLE 4.12** – TEEN CLINICAL STATISTICS (CATEGORICAL VARIABLES) (N=29)

| | Percent |
|---|---|
| Sick at time of visit | 28% |
| rhDNase | 55% |
| Antibiotics | 97% |
| Oxygen | 14% |
| Enzyme | 97% |
| Other drugs | 59% |
| Mild severity ($\%FEV_1 \geq 70$) | 65% |
| Moderate severity ($40 \leq \%FEV_1 < 70$) | 28% |
| Severe severity ($\%FEV_1 < 40$) | 7% |
| *P. aeruginosa* | 76% |
| *B. cepacia* | 0% |
| *S. aureus* | 28% |
| Other bacteria | 14% |

4. RELIABILITY

(A) ACFQ

The internal consistency reliability of the ACFQ was assessed using Cronbach's alpha for each domain that contained more than one item. Alpha was not calculated for the general health (GH) scale since it contains only one item. Table 4.13 shows the alpha coefficient for each scale in the ACFQ. The scale with the highest alpha coefficient was respiratory symptoms (SX-R) at 0.8908 and the lowest was treatment burden (TXB) at 0.0418.

**TABLE 4.13** – ACFQ DOMAIN ALPHA SCORES (N=15)

| | Alpha | N of items (Total = 62) |
|---|---|---|
| PF | 0.8018 | 11 |
| SX-R | 0.8908 | 10 |
| SX-G | 0.5332 | 5 |
| SX-P | 0.6244 | 4 |
| TXB | 0.0418 | 7 |
| SR | 0.3521 | 5 |
| W-BIA | 0.2980 | 4 |
| W-SI | 0.6219 | 5 |
| EM | 0.5507 | 11 |

(B) TCFQ

As with the ACFQ, the internal consistency reliability of the TCFQ was assessed using Cronbach's alpha for each domain that contained more than one item. Alpha was again not calculated for the general health (GH) scale since it contains only one item. Table 4.14 shows the alpha coefficient for each scale in the TCFQ. The scale with the highest alpha coefficient was respiratory symptoms (SX-R) at 0.8597 and the lowest was social role (SR) at 0.2652.

**TABLE 4.14** – TCFQ DOMAIN ALPHA SCORES (N=29)

| | Alpha | N of items (Total = 63) |
|---|---|---|
| PF | 0.8436 | 9 |
| SX-R | 0.8597 | 10 |
| SX-G | 0.5237 | 5 |
| SX-P | 0.6853 | 4 |
| TXB | 0.6596 | 6 |
| SR | 0.2652 | 7 |
| W-BIA | 0.6616 | 6 |
| W-SI | 0.6083 | 5 |
| EM | 0.8338 | 11 |

## 5. VALIDITY

### (A) ACFQ

The instrument validity was assessed primarily through correlational analysis. Table 4.15 shows the correlation coefficients for relationships between the ACFQ scores and the demographic variables for the adults. Five relationships were statistically significantly correlated, but it was the strength of the relationship that was of interest for this preliminary study. Several correlations fell within the strong category, such as the relationship between gender and worry about social interactions (W-SI). This can be interpreted as women worry more about social interactions than do men. There were also several correlations at the moderate and weak levels.

**TABLE 4.15** – CORRELATIONS BETWEEN ACFQ SCORES AND DEMOGRAPHIC VARIABLES (N=15)

| | Gender | Age | Education | Income | Hospital |
|---|---|---|---|---|---|
| GH | 0.241 | -0.286 | 0.041 | -0.323 | 0.143 |
| PF | 0.449 | -0.180 | 0.067 | 0.310 | -0.589* |
| SX-R | 0.395 | 0.101 | 0.006 | 0.047 | -0.203 |
| SX-G | -0.041 | 0.081 | -0.099 | -0.147 | -0.085 |
| SX-P | -0.259 | 0.046 | -0.199 | -0.285 | -0.189 |
| TXB | 0.207 | 0.234 | 0.076 | 0.645** | -0.615* |
| SR | 0.118 | 0.458 | 0.332 | 0.248 | -0.576* |
| W-BIA | -0.166 | -0.098 | -0.378 | -0.370 | -0.040 |
| W-SI | -0.560* | 0.072 | 0.093 | 0.211 | -0.271 |
| EM | -0.160 | -0.052 | -0.071 | 0.099 | -0.254 |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

Table 4.16 shows the correlation coefficients for relationships between the ACFQ scores and the clinical variables for the adults. The highlighted areas are those for which *a priori* hypotheses were made. Examining the strengths of the relationships, it can be seen that all but three of the hypotheses held at some level of strength of correlation. Of the 22 hypothesized relationships, 7 were at a strong level. *A priori* hypotheses were not made for the severity variable as this was simply a categorical presentation of the $FEV_1$ variable.

**TABLE 4.16 – CORRELATIONS BETWEEN ACFQ SCORES AND CLINICAL VARIABLES (N=15)**

| | BMI | $FEV_1$ | Severity | Walk test | NIH |
|---|---|---|---|---|---|
| GH | 0.148 | 0.471 | -0.367 | -0.298 | 0.341 |
| PF | 0.576* | 0.536* | -0.448 | -0.206 | 0.590* |
| SX-R | 0.682** | 0.492 | -0.205 | -0.022 | 0.509 |
| SX-G | -0.171 | 0.234 | -0.113 | 0.119 | 0.146 |
| SX-P | 0.107 | 0.362 | -0.264 | -0.260 | 0.323 |
| TXB | 0.625* | 0.526* | -0.523* | -0.059 | 0.655** |
| SR | 0.370 | 0.097 | -0.035 | 0.030 | 0.106 |
| W-BIA | 0.197 | -0.036 | 0.066 | -0.071 | 0.093 |
| W-SI | -0.143 | 0.155 | -0.156 | -0.009 | 0.108 |
| EM | -0.169 | 0.066 | 0.055 | 0.156 | 0.028 |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

(B) TCFQ

**TABLE 4.17 – CORRELATIONS BETWEEN TCFQ SCORES AND DEMOGRAPHIC VARIABLES (N=29)**

| | Gender | Age | Hospital |
|---|---|---|---|
| GH | 0.310 | 0.204 | -0.654** |
| PF | 0.224 | -0.131 | -0.671** |
| SX-R | 0.227 | -0.004 | -0.510** |
| SX-G | 0.070 | -0.168 | -0.407* |
| SX-P | 0.037 | -0.083 | 0.035 |
| TXB | 0.119 | -0.018 | -0.333 |
| SR | 0.060 | -0.259 | -0.471** |
| W-BIA | 0.025 | 0.282 | 0.029 |
| W-SI | 0.278 | 0.211 | -0.202 |
| EM | 0.180 | 0.064 | -0.318 |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

Table 4.17 shows the correlation coefficients for relationships between the TCFQ scores and the demographic variables for the teens. Admission to the hospital in the previous year was strongly associated with several domain scores, in a negative direction.

Table 4.18 shows the correlation coefficients for relationships between the TCFQ scores and the clinical variables for the teens. The highlighted areas are those for which a priori hypotheses were made. Of the 22 hypothesized relationships, 6 were at the strong level of correlation.

**TABLE 4.18** – CORRELATIONS BETWEEN TCFQ SCORES AND CLINICAL VARIABLES (N=29)

| | BMI | $FEV_1$ | Severity | Walk test | NIH |
|---|---|---|---|---|---|
| GH | 0.410* | 0.585** | -0.523** | 0.162 | 0.541** |
| PF | 0.017 | 0.498** | -0.479** | 0.229 | 0.714** |
| SX-R | 0.107 | 0.511** | -0.372* | 0.266 | 0.577** |
| SX-G | 0.012 | 0.185 | -0.249 | 0.197 | 0.340 |
| SX-P | 0.082 | 0.138 | -0.211 | 0.144 | 0.036 |
| TXB | 0.268 | 0.288 | -0.383* | 0.004 | 0.243 |
| SR | 0.240 | 0.363 | -0.519** | 0.271 | 0.550** |
| W-BIA | 0.349 | 0.349 | -0.267 | 0.011 | 0.244 |
| W-SI | 0.255 | 0.367 | -0.267 | 0.219 | 0.325 |
| EM | 0.030 | 0.405* | -0.265 | 0.261 | 0.428* |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

(c) EQ-5D

Table 4.19 shows the correlation coefficients for relationships between the ACFQ scores and the EQ-5D scores for the adults. The highlighted areas are those for which *a priori* hypotheses were made. No one reported self-care (SC) problems, so correlations could not be calculated. Of the 38 hypothesized relationships calculated, 10 were at the strong level. Only 8 of the hypothesized relationships were not at one of the levels.

**TABLE 4.19** – CORRELATIONS BETWEEN ACFQ SCORES AND EQ-5D SCORES (N=15)

| | MOB | SC | UA | P/D | A/D | VAS | Index |
|---|---|---|---|---|---|---|---|
| GH | -0.040 | - | -0.223 | -0.214 | -0.048 | 0.541* | 0.057 |
| PF | -0.618* | - | -0.738** | -0.355 | 0.159 | 0.331 | 0.418 |
| SX-R | -0.174 | - | -0.443 | -0.366 | 0.023 | 0.688** | 0.236 |
| SX-G | -0.059 | - | 0.215 | -0.626* | -0.528* | 0.134 | 0.321 |
| SX-P | -0.388 | - | -0.329 | -0.541* | -0.091 | -0.096 | 0.547* |
| TXB | -0.585* | - | -0.695** | -0.213 | 0.046 | 0.046 | 0.414 |
| SR | -0.431 | - | -0.799** | -0.052 | 0.092 | 0.292 | 0.209 |
| W-BIA | -0.136 | - | -0.066 | -0.117 | -0.023 | -0.123 | 0.103 |
| W-SI | -0.233 | - | -0.528* | 0.252 | 0.412 | -0.451 | 0.143 |
| EM | 0.020 | - | -0.249 | -0.008 | -0.576* | -0.174 | 0.145 |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

Table 4.20 shows the correlation coefficients for relationships between the TCFQ scores and the EQ-5D scores for the teens. The highlighted areas are those for which *a priori* hypotheses were made. Only two of the hypothesized relationships were not at the weak, moderate, or strong levels. Five of the hypothesized relationships were at the strong level.

**TABLE 4.20** – CORRELATIONS BETWEEN TCFQ SCORES AND EQ-5D SCORES (N=29)

| | MOB | SC | UA | P/D | A/D | VAS | Index |
|---|---|---|---|---|---|---|---|
| GH | -0.368* | - | -0.413* | -0.399* | -0.359 | 0.734** | 0.479** |
| PF | -0.416* | - | -0.441* | -0.174 | -0.312 | 0.515** | 0.367 |
| SX-R | -0.408* | - | -0.468* | -0.434* | -0.166 | 0.853** | 0.459* |
| SX-G | -0.263 | - | -0.301 | -0.292 | -0.167 | 0.150 | 0.257 |
| SX-P | -0.202 | - | -0.266 | -0.047 | -0.448* | 0.215 | 0.175 |
| TXB | -0.262 | - | -0.211 | -0.419* | -0.363 | 0.184 | 0.345 |
| SR | -0.281 | - | -0.378* | -0.046 | -0.261 | 0.229 | 0.091 |
| W-BIA | 0.147 | - | -0.054 | -0.328 | -0.312 | 0.186 | 0.434* |
| W-SI | -0.133 | - | -0.257 | -0.093 | -0.445* | 0.181 | 0.389* |
| EM | -0.400* | - | -0.509** | -0.459* | -0.446* | 0.524** | 0.693** |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

(D) SF-12

Table 4.21 shows the correlation coefficients for relationships between the ACFQ scores (left side of table) and the TCFQ scores (right side of table) and the SF-12 scores. The highlighted areas are those for which *a priori* hypotheses were made. For the ACFQ, three of the hypothesized relationships were not at any of the three levels; two were at the strong level. For the TCFQ, only one of the hypothesized relationships was not at any of the three levels; five were at the strong level.

**TABLE 4.21** – CORRELATIONS BETWEEN ACFQ / TCFQ SCORES AND SF-12 SCORES

| **ACFQ (N=15)** | PCS-12 | MCS-12 | **TCFQ (N=29)** | PCS-12 | MCS-12 |
|---|---|---|---|---|---|
| GH | 0.414 | -0.097 | GH | 0.722** | 0.542** |
| PF | 0.777** | -0.191 | PF | 0.663** | 0.401* |
| SX-R | 0.456 | -0.106 | SX-R | 0.742** | 0.512** |
| SX-G | 0.024 | 0.163 | SX-G | 0.173 | 0.293 |
| SX-P | 0.488 | -0.099 | SX-P | 0.098 | 0.312 |
| TXB | 0.531* | -0.024 | TXB | 0.351 | 0.297 |
| SR | 0.448 | 0.142 | SR | 0.309 | 0.298 |
| W-BIA | 0.070 | 0.213 | W-BIA | -0.047 | 0.226 |
| W-SI | 0.503 | -0.123 | W-SI | 0.245 | 0.274 |
| EM | 0.113 | 0.292 | EM | 0.527** | 0.617** |

* Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level.

(E) SUMMARY OF CONFIRMED HYPOTHESES

The hypothesized and observed correlations between the clinical variables and the ACFQ and TCFQ, with their signs and magnitudes, are presented in Tables 4.22 and 4.23. Those relationships that met or exceeded the hypotheses are presented in bold with highlighting. The hypothesized and observed correlations between the generic HRQOL variables and the ACFQ and TCFQ, with their signs and magnitudes, are presented in Tables 4.24 and 4.25. Those relationships that met or exceeded the hypotheses are presented in bold with highlighting.

Table 4.26 summarizes Tables 4.22 to 4.25, with each column representing one of the four tables. The percentage of correctly hypothesized relationships are indicated , with those that are 50% or above being in bold and highlighted. The general health (GH) and respiratory symptoms (SX-R) were generally correctly hypothesized for both the ACFQ and TCFQ, with especially strong results for the TCFQ. The pain symptoms (SX-P) results were also strong for the ACFQ..

**TABLE 4.22** – HYPOTHESIZED AND OBSERVED CORRELATIONS BETWEEN ACFQ SCORES AND CLINICAL VARIABLES

| | | BMI | $FEV_1$ | Walk test | NIH |
|---|---|---|---|---|---|
| GH | Hypothesized | **+ , *w/m*** | **+ , *m*** | + , *m/s* | **+ , *m*** |
| | Observed | **+ , w** | **+ , m** | - , m | **+ , m** |
| PF | Hypothesized | + , *m* | + , *s* | + , *s* | **+ , *m*** |
| | Observed | - - - | + , m | - , m | **+ , s** |
| SX-R | Hypothesized | **+ , *w/m*** | + , *s* | + , *m/s* | **+ , *s*** |
| | Observed | **+ , w** | + , m | - - - | **+ , s** |
| SX-G | Hypothesized | + , *m* | | | + , *m* |
| | Observed | - , w | | | + , w |
| SX-P | Hypothesized | | **+ , *m*** | + , *m* | **+ , *m*** |
| | Observed | | **+ , m** | - , m | **+ , m** |
| TXB | Hypothesized | | **+ , *m*** | + , *m* | **+ , *m*** |
| | Observed | | **+ , s** | - - - | **+ , s** |
| SR | Hypothesized | | + , *w* | | **+ , *w*** |
| | Observed | | - - - | | **+ , w** |

+ = positive correlation, - = negative correlation, w = weak, m = moderate, s = strong

**TABLE 4.23 – HYPOTHESIZED AND OBSERVED CORRELATIONS BETWEEN TCFQ SCORES AND CLINICAL VARIABLES**

| | | BMI | $FEV_1$ | Walk test | NIH |
|---|---|---|---|---|---|
| GH | Hypothesized | +, *w/m* | +, *m* | +, *m/s* | +, *m* |
| | Observed | +, m | +, s | +, w | +, s |
| PF | Hypothesized | +, *m* | +, *s* | +, *s* | +, *m* |
| | Observed | - - - | +, m | +, m | +, s |
| SX-R | Hypothesized | +, *w/m* | +, *s* | +, *m/s* | +, *s* |
| | Observed | +, w | +, s | +, m | +, s |
| SX-G | Hypothesized | +, *m* | | | +, *m* |
| | Observed | - - - | | | +, m |
| SX-P | Hypothesized | | +, *m* | +, *m* | +, *m* |
| | Observed | | +, w | +, m | - - - |
| TXB | Hypothesized | | +, *m* | +, *m* | +, *m* |
| | Observed | | +, m | - - - | +, w |
| SR | Hypothesized | | +, *w* | | +, *w* |
| | Observed | | +, m | | +, s |

+ = positive correlation, - = negative correlation, w = weak, m = moderate, s = strong

**TABLE 4.24 – HYPOTHESIZED AND OBSERVED CORRELATIONS BETWEEN ACFQ SCORES AND HRQOL VARIABLES**

| | | SF-12 | | EQ-5D | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PCS | MCS | MOB | SC | UA | P/D | A/D | Index | VAS |
| GH | Hyp | +, *m/s* | +, *m* | -, *s* | -, *m* | -, *m/s* | -, *m* | -, *m* | +, *s* | +, *s* |
| | Obs | +, m | --- | --- | --- | -, w | -, w | --- | +, s | --- |
| PF | Hyp | +, *s* | | -, *s* | -, *s* | -, *m* | | | +, *s* | +, *s* |
| | Obs | +, s | | -, s | --- | -, s | | | +, m | +, m |
| SX-R | Hyp | +, *m/s* | | -, *m* | | | -, *m* | | +, *s* | +, *s* |
| | Obs | +, m | | -, w | | | -, m | | +, s | +, w |
| SX-G | Hyp | +, *m/s* | | -, *m* | | | -, *m* | | +, *s* | +, *s* |
| | Obs | --- | | --- | | | -, s | | +, w | +, m |
| SX-P | Hyp | +, *m* | | -, *m* | | | -, *s* | | +, *s* | +, *s* |
| | Obs | +, m | | -, m | | | -, s | | --- | +, s |
| TXB | Hyp | +, *m* | +, *m* | | -, *m/s* | -, *m* | | -, *w* | +, *m* | +, *m* |
| | Obs | +, s | --- | | --- | -, s | | --- | --- | +, m |
| SR | Hyp | +, *m* | +, *m* | | | -, *m/s* | | | +, *m* | +, *m* |
| | Obs | +, m | +, w | | | -, s | | | +, w | +, w |
| W-BIA | Hyp | | +, *m/s* | | | | | -, *m/s* | +, *m* | +, *m* |
| | Obs | | +, w | | | | | --- | -, w | +, w |
| W-SI | Hyp | | +, *m/s* | | | | | -, *m/s* | +, *m* | +, *m* |
| | Obs | | -, w | | | | | +, m | -, m | +, w |
| EM | Hyp | | +, *s* | | | | | -, *s* | +, *m* | +, *m* |
| | Obs | | +, w | | | | | -, s | -, w | +, w |

+ = positive correlation, - = negative correlation, w = weak, m = moderate, s = strong

**TABLE 4.25 – HYPOTHESIZED AND OBSERVED CORRELATIONS BETWEEN TCFQ SCORES AND HRQOL VARIABLES**

| | | SF-12 | | EQ-5D | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PCS | MCS | MOB | SC | UA | P/D | A/D | Index | VAS |
| GH | Hyp | +, *m/s* | +, *m* | -, *s* | -, *m* | -, *m/s* | -, *m* | -, *m* | +, *s* | +, *s* |
| | Obs | +, s | +, s | -, m | --- | -, m | -, m | -, m | +, s | +, m |
| PF | Hyp | +, *s* | | -, *s* | -, *s* | -, *m* | | | +, *s* | +, *s* |
| | Obs | +, s | | -, m | --- | -, m | | | +, s | +, m |
| SX-R | Hyp | +, *m/s* | | -, *m* | | | -, *m* | | +, *s* | +, *s* |
| | Obs | +, s | | -, m | | | -, m | | +, s | +, m |
| SX-G | Hyp | +, *m/s* | | -, *m* | | | -, *m* | | +, *s* | +, *s* |
| | Obs | +, w | | -, w | | | -, w | | +, w | +, w |
| SX-P | Hyp | +, *m* | | -, *m* | | | -, *s* | | +, *s* | +, *s* |
| | Obs | --- | | -, w | | | --- | | +, w | +, w |
| TXB | Hyp | +, *m* | +, *m* | | -, *m/s* | -, *m* | | -, *w* | +, *m* | +, *m* |
| | Obs | +, w | +, w | | --- | -, w | | --- | +, w | +, m |
| SR | Hyp | +, *m* | +, *m* | | | -, *m/s* | | | +, *m* | +, *m* |
| | Obs | +, w | +, w | | | -, m | | | +, w | --- |
| W-BIA | Hyp | | +, *m/s* | | | | | -, *m/s* | +, *m* | +, *m* |
| | Obs | | +, w | | | | | --- | +, w | +, m |
| W-SI | Hyp | | +, *m/s* | | | | | -, *m/s* | +, *m* | +, *m* |
| | Obs | | +, w | | | | | -, m | +, w | +, m |
| EM | Hyp | | +, *s* | | | | | -, *s* | +, *m* | +, *m* |
| | Obs | | +, s | | | | | -, m | +, s | +, s |

+ = positive correlation, - = negative correlation, w = weak, m = moderate, s = strong

**TABLE 4.26 – PERCENTAGE OF CORRECTLY HYPOTHESIZED RELATIONSHIPS**

| | ACFQ | | TCFQ | |
|---|---|---|---|---|
| | Clinical | HRQOL | Clinical | HRQOL |
| GH | **75%** | 22% | **75%** | **67%** |
| PF | 25% | **50%** | 25% | **50%** |
| SX-R | **50%** | **60%** | **100%** | **80%** |
| SX-G | 0% | 20% | **50%** | 0% |
| SX-P | **67%** | **80%** | 33% | 0% |
| TXB | **67%** | 43% | 33% | 14% |
| SR | **50%** | 40% | **100%** | 20% |
| W-BIA | --- | 0% | --- | 25% |
| W-SI | --- | 0% | --- | **50%** |
| EM | --- | 25% | --- | **75%** |

## V. DISCUSSION

The purpose of this project was to develop and report preliminary evidence on the measurement properties of new CF-specific HRQOL instruments for adults (ACFQ) and adolescents (TCFQ). The ACFQ and TCFQ were interviewer-administered and took less than ten minutes to complete. The ACFQ and the TCFQ included ten domains that measure general health, physical function, respiratory symptoms, GI symptoms, pain symptoms, treatment burden, social role, worry about body image and awareness, worry about social interaction, and emotions. The instruments were well understood by the patients, as reported by the interviewers.

A standard process for instrument development was followed (Juniper et al., 1996b). Items were generated through a review of the literature, discussions with health professionals, and focus groups. Clinical impact analysis was used, as opposed to factor analysis, for item reduction. Factor analysis could be used to confirm the factors or domains (Fayers and Hand, 1997). The questionnaire formats were standardized, with the appropriate item stems and multiple response options. Scoring consisted of calculating a pro-rated score (out of 100) for each of the ten domains.

In the clinical testing phase of the instrument development, 15 adults and 29 teens participated. Their scores on the ACFQ and TCFQ indicated large individual variation. Several people rated themselves at the ceiling (i.e., score of 100) for many of the domains, although, when the range was examined, it can be seen that some people also rated themselves on the lower end, being quite sick. Generally speaking, the teenagers rated themselves higher than the adults in all domains except treatment burden and worry about body image and awareness. It must be kept in mind though, that not all of the ten scales are strictly comparable between the ACFQ and TCFQ since they contain different items.

Internal consistency reliability was assessed using Cronbach's alpha coefficient. An alpha coefficient above 0.7 is considered to show good reliability. The ACFQ scales in which alpha was over 0.7 were: respiratory symptoms at 0.89 and physical function at 0.80. The TCFQ scales in which alpha was over 0.7 were: respiratory symptoms at 0.86, physical function at 0.84, and emotions at 0.83. For these scales, the instruments showed good internal consistency reliability. This is important since respiratory symptoms and physical function tend to be the areas with the most limitations for people with CF.

The alpha coefficients for most of the other scales for the two instruments fell between 0.5 and 0.7, except for the TCFQ's social role at 0.27 and the ACFQ's treatment burden at 0.04, social role at 0.35, worry about body image and awareness at 0.30. The ACFQ treatment burden scale, having such a low alpha score, appeared to not be internally consistent. The correlations in the validity section would therefore also be lower than if the alpha coefficient had been higher. However, significant correlations were observed with several clinical variables and treatment

burden. The impact of the treatment burden score being so low was that the items were not all measuring the same thing and, therefore, should not be grouped together. In the case where a correlation was expected, it might not appear because the alpha was so low. Additional consideration should be given to the individual items contained in the separate domains.

Because the treatment burden reliability score was very low for the adults, but not for the teens, a closer look was taken as to the possible reasons. One item was included in the ACFQ that was not in the TCFQ: "How often do you worry about not being able to afford treatments?" When that item was removed from the treatment burden domain, the alpha coefficient increased to 0.46, which was closer to the other low scores. In the future, this item should be left out of the treatment burden scale. It should not be excluded from the instrument because it is still important, but it just does not fit with the other items in the treatment burden domain.

The validity of the ACFQ and TCFQ was mainly assessed using correlational analyses. Correlations were calculated between the ten scales in each instrument and clinical variables, as well as generic HRQOL scores. Since the sample size was fairly small, many of the results were not statistically significant, but it was the strength of the relationships that was of the most interest for this preliminary testing.

Overall, the hypotheses for relationships between the general health and respiratory symptoms domains and the clinical and HRQOL variables held for both instruments. The results for these two domains were especially strong for the TCFQ. The pain symptoms domain was also confirmed in the ACFQ. These initial tests showed some evidence of validity, but further work will be required in larger populations to provide more sound evidence of validity.

The previous literature used the clinical variables $FEV_1$, BMI, and NIH score to compare with their HRQOL scores. $FEV_1$ was used in the majority of the studies and the overall result was that $FEV_1$ was significantly positively correlated at a medium to strong level with the various HRQOL scores (Congleton et al., 1996; Johnson et al., 1999; Munzenberger et al., 1999; Orenstein et al., 1989; Orenstein et al., 1990; Powers, 1998). These results were similar to the results from the ACFQ and the TCFQ, which had medium to strong positive correlations with general health, physical function, respiratory symptoms, pain symptoms, treatment burden, and social role.

The NIH score was tested by Czyzewski (1994, 1998) and had a positively, weakly correlated relationship with the QWB score. The results of this study showed the NIH scores to be moderately to strongly, positively correlated with most of the ACFQ and TCFQ domains, such as general health, physical function, respiratory symptoms, GI symptoms, pain symptoms, treatment burden, and social role.

BMI was examined by Congleton (1996) and found to have a positively, weakly correlated relationship with the NHP score. The results of this study showed the ACFQ and the TCFQ to be positively moderately to strongly correlated with the general health, physical function, and respiratory symptoms domains.

The walk test was not tested in other HRQOL studies. In this study, it did not end up being as useful at predicting HRQOL as might have been expected, since it ended up being negative instead of positive, or else lower than the weak level of magnitude. The reason might be that it was not sensitive enough to measure each individual's level of functional capacity. It depended a great deal on personal motivation, as noted by the physiotherapists. Certain people's personalities were such that, even if they were feeling sick, they pushed themselves during the test. Others, who were not sick, simply took their time during the test.

It has not been possible to fully examine the other CF-specific questionnaires that are being developed, simply due to the fact that they are in the development phase, as are the ACFQ and TCFQ. But, in comparing the ACFQ and TCFQ to what is known about the existing CF questionnaires, the ACFQ and TCFQ seem to be unique in that the focus is broad and includes all aspects of importance to people with CF, rather than simply being an index of respiratory symptoms. Most of the existing instruments are being developed for adults, and, while the ACFQ has been developed for administration to adults, the TCFQ has been developed for administration to teenagers. Rather than being a parent-report instrument, the adolescents answer the TCFQ themselves, thus eliminating proxy biases.

An important component of the CF population is the young children. Assessing HRQOL in children is as equally important as in adults and adolescents, but offers many more challenges (Connolly and Johnson, 1999). For example, using parents as proxy respondents or, if the children answer themselves, how young is too young to understand the question, their disease, or the time frame. Juniper et al. (1996a) suggest seven years as the minimum age when children have the skills to be the respondents.

In CF, Connolly et al. (1998) have assessed HRQOL in young children using generic instruments (FS-II[R] and RAND Child Health Instrument) that were parent-reported. Overall, the parents' reports of their children's health were lower than the normal population results. Because parents' reports are indirect accounts of their children's health, it is preferable to have the children answer themselves. It is possible to do so by having the instrument interviewer administered to minimize reading and comprehension problems. Pictures can be used to help the children understand certain concepts.

Initially, a younger age group from 6 to 11 years old, was also considered in this project. It was decided to focus on the adolescents in the first instance, although it was anticipated that the TCFQ could be modified for use in younger patients, as either interviewer administered, or perhaps with parents as proxies.

A limitation of this study was the small sample size, especially for the ACFQ (N=15). This affected the correlational analyses in causing some relationships to be non-significant. The sample size for the adolescent group (N=29) was more adequate for this first attempt at determining properties. Additional work is required though, including applications in clinical studies to assess the usefulness and interpretability of the instruments.

Further work on the instrument should be undertaken to determine the causes of the generally low alpha coefficients. Exploratory factor analysis could be used to determine which items are correlated and then regroup them into new scales to try to improve their reliability. If testing over time, it is also possible to assess test-retest reliability. The same group of people could be asked the same questions in two to three weeks and the results would be compared with their initial scores. This would show the instruments' reproducibility over time.

While the instruments were used for discriminative purposes with cross-sectional data in this study, the next step would be to use it for evaluative purposes and determine longitudinal construct validity. It could also be used for predictive purposes, for example, predicting hospitalizations or mortality.

Future work could also include comparing the EQ-5D and SF-12 scores with published norms to determine the level of HRQOL of this group of patients with CF compared to normal populations. Using the EQ-5D and SF-12 as concurrent measures for the construct validity did have its limitations however. The self-care (SC) dimension of the EQ-5D had no variance, and therefore the hypothesized relationships were not observed. This could have been due to the limiting ceiling effect of the EQ-5D, rather than the lack of a true relationship.

In future work, the questionnaires could be revised to have the same ordering of the questions. The reason that the adult and teen versions have different ordering of items is simply that it was an artifact of the original ranking. There are two thoughts in the ranking literature: (1) since they are concepts, it should not matter where the questions rank because people will give the same answer regardless, or (2) a framing effect can occur, but it will have a small impact and is, therefore, not important. A recommendation for further work would be to revise the questionnaire and put the items in the same order, clearly indicating the areas of similarities and difference between the two questionnaires.

Future work would also involve refining, or shortening, the questionnaires. If certain items are found to be redundant and not adding to the validity of the instrument, they could be removed. This has been done successfully with other instruments such as the SF-36 being reduced to the SF-12 (Jenkinson et al., 1997; Jenkinson and Layte, 1997). A shorter measure can provide similar data while reducing the respondent burden.

## CONCLUSION

Two versions of a CF-specific HRQOL instrument were developed: the ACFQ for adults and the TCFQ for adolescents. Both have ten domains: general health, physical function, respiratory symptoms, GI symptoms, pain symptoms, treatment burden, social role, worry about body image and awareness, worry about social

interactions, and emotions. They were interviewer administered and took less than ten minutes to complete.

Preliminary evidence of the validity and internal consistency reliability in a discriminative (cross-sectional) analysis was shown. Reasonable measurement properties for the general health and respiratory symptoms dimensions were demonstrated to exist, while additional refinement and testing is required for the other scales.

As with any instrument development, additional application is required, and over time, an accumulation of experience and evidence of the measurement properties will be required. If the instruments are to be used for evaluative purposes, additional evidence of test-retest reliability and longitudinal construct validity will be required.

## REFERENCES


Abbott J, Webb K, Dodd M. Quality of life in cystic fibrosis. *Journal of the Royal Society of Medicine* 1997;90(Suppl.31): 37-42.

Anonymous. Glossary. *PharmacoEconomics* 1998;13:109-110.

Bartholomew LK, Czyzewski DI, Parcel GS, et al. Self-management of cystic fibrosis: short-term outcomes of the cystic fibrosis family education program. *Health Education & Behavior* 1997;24:652-666.

Bell SC, Bowerman AR, Davies CA, et al. Nutrition in adults with cystic fibrosis. *Clinical Nutrition* 1998;17:211-215.

Berzon RA. Understanding and using health-related quality of life instruments within clinical research studies. In *Quality of Life Assessment in Clinical Trials: Methods and Practice*, edited by MJ Staquet, RD Hays, PM Fayers. Oxford: Oxford University Press, 1998.

Bessette L, Sangha O, Kuntz KM, et al. Comparative responsiveness of generic versus disease-specific and weighted versus unweighted health status measures in carpal tunnel syndrome. *Medical Care* 1998;36:491-502.

Blair C, Cull A, Freeman CP. Psychosocial functioning of young adults with cystic fibrosis and their families. *Thorax* 1994;49:789-802.

Blair C, Kacser E, Porteous D. Gene therapy for cystic fibrosis: A psychosocial study of trial participants. *Gene Therapy* 1998;5:218-222.

Britto MT, Wilmott RW, Kotagal UR, et al. The association between clinical disease severity and quality of life in patients with cystic fibrosis [abstract]. *Pediatric Pulmonology* 1999;Suppl:325.

Bussbach JJV, Horick PE, van den Bosch JMM, et al. Measuring the quality of life before and after bilateral lung transplantation in patients with cystic fibrosis. *Chest* 1994;105:911-917.

Butland RJA, Pang J, Gross ER, et al. Two-, six-, and 12-minute walking tests in respiratory disease. *BMJ* 1982;284:1607-1608.

Caine N. Sharples LD, Smyth R, et al. Survival and quality of life of cystic fibrosis patients before and after heart-lung transplantation. *Transplantation Proceedings* 1991;23:1203-1204.

CCOHTA. *Guidelines for Economic Evaluation of Pharmaceuticals: Canada.* 2nd ed. Ottawa: Canadian Coordinating Office for Health Technology Assessment (CCOHTA), 1997.

Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers, 1988.

Congleton J, Hodson ME, Duncan-Skingle F. Quality of life in adults with cystic fibrosis. *Thorax* 1996;51:936-940.

Congleton J, Hodson ME, Duncan-Skingle F. Quality of life in adults with cystic fibrosis. *European Respiratory Review* 1997;7:74-76.

Congleton J, Hodson ME, Duncan-Skingle F. Do Nottingham Health Profile scores change over time in cystic fibrosis? *Respiratory Medicine* 1998;92:268-272.

Connolly M, Johnson JA. Measuring Quality of Life in Pediatric Patients. *PharmacoEconomics* 1999;16:605-625.

Connolly M, Johnson JA, Zuberbuhler P. Health-related quality of life of pediatric CF patients [abstract]. *Annual Meeting of International Society of Technology Assessment in Health Care* 1998;14:71.

Corey M, Farewell V. Determinants of mortality from cystic fibrosis in Canada, 1970-1989. *American Journal of Epidemiology* 1996;143:1007-1017.

Cowen L, Corey M, Simmons R, et al. Growing older with cystic fibrosis: psychologic adjustment of patients more than 16 years old. *Psychosomatic Medicine* 1984;46:363-376.

Cronbach LJ. Coefficent alpha and the internal structure of tests. *Psychometrika* 1951;16:297-315.

Czyzewski DI, Bartholomew LK. Quality of life outcomes in children and adolescents with cystic fibrosis. In *Measuring Health-Related Quality of Life in Children and Adolescents: Implications for Research and Practice*, ed: D Drotar. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers, 1998: 203-218.

Czyzewski DI, Mariotto MJ, Bartholomew LK, et al. Measurement of Quality of Well-Being in a child and adolescent cystic fibrosis population. *Medical Care* 1994;32:965-972.

de Jong W, Kaptein AA, van der Schans CP, et al. Quality of life in patients with cystic fibrosis. *Pediatric Pulmonology* 1997;23:95-100.

Dennis C, Caine N, Sharples L, et al. Heart-lung transplantation for end-stage respiratory disease in patients with cystic fibrosis at Papworth Hospital. *Journal of Heart & Lung Transplantation* 1993;12:893-902.

DeVillis RF. *Scale Development – Theory and Applications*. Newbury Park, CA: Sage Publications, 1991.

Deyo RA, Diehr P, Patrick DL. Reproducibility and responsiveness of health status measures. *Controlled Clinical Trials* 1991;12:142S-158S.

Dolan P. Modelling valuations for EuroQol health states. *Medical Care* 1997;35:1095-1108.

Dunlevy CL, Douce FH, Hill E, et al. Physiological and psychological effects of low-impact aerobic exercise on young adults with cystic fibrosis. *Journal of Cardiopulmonary Rehabilitation* 1994;14:47-51.

Eakin EG, Resnikoff PM, Prewitt LM, et al. Validation of a new dyspnea measure – The UCSD Shortness of Breath Questionnaire. *Chest* 1998;113:619-624.

Eisen M, Ware JE, Donald CA, et al. Measuring components of children's health status. *Medical Care* 1979;17:902-921.

Epker J, Maddrey M. A subjective index of quality of life in adult patients with CF: SF-36 [abstract]. *Pediatric Pulmonology* 1999;Suppl:327.

Fayers PM, Hand DJ. Factor analysis, causal indicators and quality of life. *Quality of Life Research* 1997;6:139-150.

Feeny DH, Torrance GW, Furlong WJ. Health Utilities Index. In *Quality of Life and Pharmacoeconomics in Clinical Trials*, ed: B Spilker. Philadelphia: Lippincott-Raven Publishers, 1996: 239-252.

FitzSimmons SC. The changing epidemiology of cystic fibrosis. *Current Problems in Pediatrics* 1994;3:171-179.

Fowler FJ. *Survey Research Methods*. Newbury Park, CA: Sage Publications, 1993.

French DJ. Quality of life in cystic fibrosis. *Thorax* 1998;53:721-722.

Fuchs HJ, Borowitz DS, Christiansen DH, et al. Effects of aerosolized recombinant human DNase on exacerbations of respiratory symptoms and on pulmonary function in patients with cystic fibrosis. *New England Journal of Medicine* 1994:331:637-642.

Gee L, Abbott J, Conway S, et al. A disease specific health related quality of life measure for adults with CF [abstract]. *Pediatric Pulmonology* 1999a;Suppl:326.

Gee L, Abbott J, Conway S, et al. Testing and validation of the SF-36 as a suitable quality of life measure for adults with CF [abstract]. *Pediatric Pulmonology* 1999b;Suppl:326.

Gilligan PH. Microbiology of cystic fibrosis lung disease. In *Cystic Fibrosis in Adults*, edited by JR Yankaskas and MR Knowles. Philadelphia, PA; Lippincott-Raven Publishers, 1999: 93-114.

Goa KL, Lamb H. Dornase alfa: A review of pharmacoeconomic and quality of life aspects of its use in cystic fibrosis. *PharmacoEconomics* 1997;12:409-422.

Gulmans VA, van Veldhoven NH, de Meer K, et al. The six-minute walking test in children with cystic fibrosis. *Pediatric Pulmonology* 1996;22:85-89.

Guyatt GH, Feeny DH, Patrick DL. Measuring health-related quality of life. *Annals of Internal Medicine* 1993;118:622-629.

Guyatt GH, Jaeschke R, Feeny DH, et al. Measurements in clinical trials: Choosing the right approach. In *Quality of Life and Pharmacoeconomics in Clinical Trials*, ed: B Spilker. Philadelphia: Lipponcott-Raven Publishers, 1996: 41-48.

Guyatt GH, Pugsley SO, Sullivan MJ, et al. Effect of encouragement on walking test performance. *Thorax* 1984;39:818-822.

Guyatt GH, Thompson PJ, Berman LB, et al. How should we measure function in patients with chronic heart and lung disease? *Journal of Chronic Disease* 1985;38:517-524.

Hays RD, Anderson R, Revicki D. Psychometric considerations in evaluating health-related quality of life instruments. *Quality of Life Research* 1993;2:441-449.

Heijerman HG, van Rossem RN, Bakker W. Effect of rhDNase on lung function and quality of life in adult cystic fibrosis patients. *Netherlands Journal of Medicine* 1995;46:293-297.

Henry B, Aussage P, Grosskopf C, et al. Measuring quality of life in children with cystic fibrosis: The Cystic Fibrosis Questionnaire (CFQ) [abstract]. *Quality of Life Research* 1997;6:657.

Henry B, Aussage P, Grosskopf C, et al. Evaluating quality of life (QoL) in children with cystic fibrosis (CF): Should we believe the child or the parent? [abstract]. *Quality of Life Research* 1998a;7:607.

Henry B, Aussage P, Staab D, et al. Assessing cross-cultural validity of the cystic fibrosis questionnaire (CFQ) [abstract]. *Quality of Life Research* 1998b;7:606-607.

Jenkinson C, Layte R. Development and testing of the UK SF-12. *Journal of Health Services and Research Policy* 1997;2:14-18.

Jenkinson C, Layte R, Jenkinson D, et al. A shorter form health survey: Can the SF-12 replicate results from the SF-36 in longitudinal studies? *Journal of Public Health Medicine* 1997;19:179-186.

Johnson JA, Connolly M, Brown N. Health-related quality of life of adult CF patients [abstract]. *Annual Meeting of International Society of Technology Assessment in Health Care* 1998;14:38.

Johnson JA, Connolly M, Zuberbuhler P, et al. Health-related quality of life for adult and pediatric cystic fibrosis patients: A regression approach to assessing the impact of recombinant human DNase. *Institute of Health Economics Working Paper 99-8*, 1999.

Juniper EF, Guyatt GH, Feeny DH, et al. Measuring quality of life in children with asthma. *Quality of Life Research* 1996a;5:35-46.

Juniper EF, Guyatt GH, Jaeschke R. How to develop and validate a new health-related quality of life instrument. In: *Quality of Life and Pharmacoeconomics in Clinical Trials*, edited by B. Spilker. Philadelphia: Lippincott-Raven Publishers, 1996b.

Juniper EF, Guyatt GH, Ferrie PJ, Griffith LE. Measuring quality of life in asthma. *American Review of Respiratory Disease* 1993;147:832-838.

Juniper EF, Guyatt GH, Streiner DL, et al. Clinical Impact versus factor analysis for quality of life questionnaire construction. *Journal of Clinical Epidemiology* 1997;50:233-238.

Kachigan SK. *Statistical Analysis – An Interdisciplinary Introduction to Univariate and Multivariate Methods*. New York, NY: Radius Press, 1986.

Kaplan RM, Anderson JP, Wu AW, et al. The Quality of Well-Being Scale. Applications in AIDS, cystic fibrosis, and arthritis. *Medical Care* 1989;27:S27-S43.

Keilen M, Treasure T, Schmidt U, et al. Quality of life measurements in eating disorders, angina, and transplant candidates: Are they comparable? *Journal of the Royal Society of Medicine* 1994;87:441-444.

Kerem E, Reisman J, Corey A, et al. Prediction of mortality in patients with cystic fibrosis. *New England Journal of Medicine* 1992;326:1187-1191.

Kind P. The EuroQoL Instrument: An index of health-related quality of life. In: *Quality of Life and Pharmacoeconomics in Clinical Trials*, edited by B. Spilker. Philadelphia, PA: Lippincott-Raven Publishers, 1996:191-201.

Knowles MR, Friedman KJ, Silnerman LM. Genetics, diagnosis, and clinical phenotype. In: *Cystic Fibrosis in Adults*, edited by JR Yankaskas and MR Knowles. Philadelphia, PA: Lippincott-Raven Publishers, 1999: 27-42.

Krueger RA. Group dynamics and focus groups. In: *Quality of Life and Pharmacoeconomics in Clinical Trials*, edited by B. Spilker. Philadelphia, PA: Lippincott-Raven Publishers, 1996.

Lindstrom B, Eriksson B. Quality of life for children with disabilities. *Soz Praventivmed* 1993;338:83-89.

Lindstrom B, Eriksson B, Jakobsson G, et al. Quality of life and child health problems in the Nordic countries. In *The Essence of Existence: On the Quality of Life of Children in the Nordic Countries,* edited by B Lindstrom. Sweden: The Nordic School of Public Health, 1994: 1-23.

Lindstrom B, Kohler L. Youth, disability and quality of life. *Pediatrician* 1991;18:121-128.

MacKeigan LD, Pathak DS. Overview of health-related quality-of-life measures. *American Journal of Hospital Pharmacy* 1992;49:2236-2245.

Mannes GPM, Essink-Bot ML, Koeter GH, et al. Lung transplantation and quality of life: preliminary results. *European Respiratory Review* 1997;7:100-104.

McGarrahan A, Epker J, Maddrey M, et al. Children's quality of life from the parents' perspective: A comparison of CF and other chronic illnesses using the Child Health Questionnaire [abstract]. *Pediatric Pulmonology* 1999;Suppl:328.

Mellis CJ. Effect of rhDNase on quality of life and spirometry in patients with cystic fibrosis [abstract]. *Australian & New Zealand Journal of Medicine* 1997;27:257.

Moise JR, Drotar D, Doershuk CF, et al. Correlates of psychosocial adjustment among young adults with cystic fibrosis. *Journal of Developmental and Behavioral Pediatrics* 1987;8:141-148.

Munzenburger PJ, Van Wagnen CA, Abdulhamid I, et al. Impact of dornase alfa (Pulmozyme) on quality of life in patients with mild cystic fibrosis [abstract]. *Pharmacotherapy* 1996;16:515.

Munzenburger PJ, Van Wagnen CA, Abdulhamid I, et al. Quality of life as a treatment outcome in patients with cystic fibrosis. *Pharmacotherapy* 1999;19:393-398.

Nir M, Lanng S, Johansen HK, et al. Long-term survival and nutritional data in patients with cystic fibrosis treated in a Danish centre. *Thorax* 1996;51:1023-1027.

Nunally JC. *Psychometric Theory, 2nd Edition*. New York: McGraw-Hill, 1979.

O'Brien B. Measurement of health-related quality of life in the economic evaluation of medicines. *Drug Information Journal* 1994;28:45-53.

Orenstein DM, Nixon PA, Ross EA, et al. The quality of well-being in cystic fibrosis. *Chest* 1989;95:344-347.

Orenstein DM, Pattishall EN, Nixon PA, et al. Quality of well-being before and after antibiotic treatment of pulmonary exacerbations in patients with cystic fibrosis. *Chest* 1990;98:1081-1084.

Orenstein DM, Kaplan RM. Measuring the quality of well-being in cystic fibrosis and lung transplantation. *Chest* 1991;100:1016-1018.

Powers MM. *Adolescents with Cystic Fibrosis: Adolescent, Mother and Father Reports of Child Health and Pulmonary Function* [Ph.D. Dissertation]. Tufts University, 1998.

Powers M, Abetz L. Child and maternal reports of health-related quality of life as it relates to pulmonary function in adolescents with cystic fibrosis [abstract]. *Quality of Life Research* 1997;6:703.

Quittner AL. Measurement of quality of life in cystic fibrosis. *Current Opinion in Pulmonary Medicine* 1998;4:326-331.

Quittner AL, Espelage DL, Watrous ML, et al. U.S. validation of a disease-specific quality of life measure for cystic fibrosis: The Cystic Fibrosis Questionnaire (CFQ) [abstract]. *Pediatric Pulmonology* 1999;Suppl:326-7.

Quittner AL, Munzenberger PJ. Measuring quality of life in patients with cystic fibrosis: Development of a disease-specific measure. *ESCF Update: The Newsletter of the Epidemiologic Study of Cystic Fibrosis* 1999a;3:1-3.

Ramsey BW, Astley SJ, Aitken ML, et al. Efficacy and safety of short-term administration of aerosolized recombinant human deoxyribonuclease in patients with cystic fibrosis. *American Review of Respiratory Diseases* 1993;148:145-151.

Ramsey BW, Boat TF. Outcome measures for clinical trials in cystic fibrosis. Summary of a Cystic Fibrosis Foundation consensus conference. *Journal of Pediatrics* 1994;124:177-192.

Ranasinha C, Assoufi B, Shak S, et al. Efficacy and safety of short-term administration of aerosolised recombinant human DNase I in adults with stable stage cystic fibrosis. *Lancet* 1993;342:199-202.

Resnikoff JR, Conrad DJ. Recent advance in the understanding and treatment of cystic fibrosis. *Current Opinion in Pulmonary Medicine* 1998;4:130-134.

Sawyer SM, Rosier MJ, Phelan PD, et al. The self-image of adolescents with cystic fibrosis. *Journal of Adolescent Health* 1995;16:204-208.

Sennhauser FH. Quality of life in chronic respiratory disorders in children. *European Respiratory Review* 1997;7:77-81.

Shah PI, Bush A, Canny GJ, et al. Recombinant human DNase I in cystic fibrosis patients with severe pulmonary disease: A short-term, double-blind study followed by six months open-label treatment. *European Respiratory Journal* 1995;8:954-958.

Shepherd SL, Hovell MF, Slymen DJ, et al. Functional status as an overall measure of health in adults with cystic fibrosis: Further validation of a generic health measure. *Journal of Clinical Epidemiology* 1992;45:117-125.

Simmons RJ, Corey M, Cowen L, et al. Behavioral adjustment of latency age children with cystic fibrosis. *Psychosomatic Medicine* 1987;49:291-301.

Simmons RJ, Corey M, Cowen L, et al. Emotional adjustment of early adolescents with cystic fibrosis. *Psychosomatic Medicine* 1985;47:111-122.

Smith MS, Treadwell M, O'Grady L. Psychosocial functioning, life change, and clinical status in adolescents with cystic fibrosis. *Journal of Adolescent Health Care* 1983;4:230-234.

Sockrider MM, Swank PR, Seilheimer DK, et al. Measuring clinical status in cystic fibrosis: Internal validity and reliability of a Modified NIH Score. *Pediatric Pulmonology* 1994;17:86-96.

Staab D, Wenninger K, Bisson S, et al. Quality of life in parents of children with cystic fibrosis: relation to severity of disease and ways of coping [abstract]. *Quality of Life Research* 1997;6:726.

Staab D, Wenninger K, Gebert N, et al. Quality of life in patients with cystic fibrosis and their parents: What is important besides disease severity? *Thorax* 1998;53:727-731.

Stein RE, Jessop DJ. Functional Status II-R: A measure of child health status. *Medical Care* 1990;28:1041-1055.

Streiner DL, Norman GR. *Health Measurement Scales: A Practical Guide to Their Development and Use.* New York, NY: Oxford University Press, 1995.

Taussig LM, Kattwinkel J, Friedewald WT, et al. A new prognostic score and clinical evaluation system for cystic fibrosis. *Journal of Pediatrics* 1973;82:380.

Tullis ED, Gilljam M, Corey M. Development of a CF-specific quality of life instrument for adults with cystic fibrosis [abstract]. *Pediatric Pulmonology* 1999;Suppl:327.

Tullis ED, Guyatt GH. Quality of life in cystic fibrosis. *PharmacoEconomics* 1995;8:23-33.

Upton CJ, Tyrrell JC, Hiller EJ. Two minute walking distance in cystic fibrosis. *Archives of Disease in Childhood* 1988;63:1444-1448.

Ware JE, Kosinski M, Keller SD. *SF-36 Physical and Mental Health Summary Scales: A User's Manual.* Boston, MA: The Health Institute, New England Medical Center, 1994.

Ware JE, Kosinski M, Keller S. *Scoring Manual for the Short Form 36-item Health Survey (SF-36).* Medical Outcomes Trust; Boston, MA, 1995a.

Ware JE, Kosinski M, Keller SD. *SF-12: How to Score the SF-12 Physical and Mental Health Summary Scales.* Boston, MA: The Health Institute, New England Medical Center, 1995b.

Ware JE, Kosinski M, Keller SD. A 12-item Short-Form Health Survey: Construction of scales and preliminary test of reliability and validity. *Medical Care* 1996;34:220-226.

Ware JE, Jr., Sherbourne CD. The MOS 36-item Short-Form Health Survey (SF-36). I. Conceptual framework and item selection. *Medical Care* 1992;30:473-483.

Ware JE, Snow KK, Kosinski M, Gandek B. *SF-36 Health Survey: Manual and Interpretation Guide.* Boston, MA: The Health Institute, New England Medical Center, 1993.

Weir DC, Freeman W, Roberts KT, et al. Comparison of a measure of quality of life in patients with cystic fibrosis (CF) and chronic airflow obstruction (CAO) [abstract]. *Thorax* 1991; 46:288P.

Wenninger K, Staab D, Bisson S, et al. Relation of disease severity and coping to quality of life in patients with cystic fibrosis [abstract]. *Quality of Life Research* 1997;6:741.

Wilmott RW, Amin RS, Colin AA, et al. Aerosolized recombinant human DNase in hospitalized cystic fibrosis patients with acute pulmonary exacerbations. *American Journal of Respiratory & Critical Care Medicine* 1996;153:1914-1917.

Wolter JM, bowler SD, Nolan PJ, et al. Home intravenous therapy in cystic fibrosis: A prospective randomized trial examining clinical, quality of life and cost aspects. *European Respiratory Journal* 1997;10:896-900.

World Health Organization. Constitute of the World Health Organization. Annex I. In *The First Ten Years of the World Health Organization*. Geneva: World Health Organization, 1958.

# APPENDIX I

## FOCUS GROUP SCRIPTS

**Adult CF Patients Quality of life – Focus Group Discussion**

**1. Introduction**

Thank you for coming this morning. My name is Carlyn and this is Melinda who will be helping me.

As you can see, we're taping this discussion so that we don't have to take notes. This discussion is anonymous – we won't be associating your full names with what you say in here – which means we want to use you first names only today, OK?

First, we have to be sure that all of you have had a chance to review the information about this project and have signed the required forms.

<<Check to see if all have signed consent forms.>>

You have been asked to come here today because we are interested in finding out about your daily activities, and the impact of cystic fibrosis on the quality of your life. We are talking to people with CF now so we can learn first-hand about your experiences and perceptions. Your input will help us to assess the quality of life of people with CF. The people who are running this research project will use the information we talk about today to put together a standard questionnaire that can be used in other settings.

Some of the things that we will talk about today may be sensitive issues for you. If you don't feel comfortable speaking about them, you don't have to answer the questions. Also if you don't feel comfortable talking about some things you are free to leave the room too.

Let's begin by going around the table. I'd like you to tell us your first name.

Now I would like to discuss how CF impacts you in the things you do and how you feel.

**link name and description of good day to decrease time.

**2. Daily Activities**

*General*

Describe a typical "good day".

If you have "bad days" what is that kind of day like?

-Prompt: (if necessary) How does CF affect the activities you like to do?

*Energy/Exercise*

Do you think you have less energy than people like you who don't have CF?

*Sleep*

Are you generally satisfied or dissatisfied with the quality of your sleep?

Does your CF interfere with your sleeping? If so, how?

*Diet*

Do you have trouble eating as much as you should? If so, why? (probe: hard to fit in? money? physically unable?)

Do you like the things that are supposed to be part of your diet? (probe: diet supplements)?

**3. Relationships**

Do you feel comfortable telling other people you have CF? How do you feel about having to explain all of the time to others how you are feeling?

Do you worry about how CF will affect your relationships with other friends or co-workers?

Does CF affect your relationships with your family?

What about relationships with your spouse or girlfriend or boyfriend?

Does CF affect your sexual relationships?

Do you think about having children?

**4. Body Image**

How does having CF make you feel about yourself? Does having CF make you feel self-conscious?(probes: try to hide CF?)

Have these feelings changed with age?

**5. Symptoms**

What conditions or symptoms are you limited by and how does each one limit you?

- shortness of breath/breathlessness
- coughing
- chest pains
- gas
- stomach cramps/aches
- headaches
- achy joints
- muscle pains

**6. Treatment burden**

How much time do you spend on your CF treatments (probe: chest physio, nebulizations, and diet)? How many hours per day?

Have you ever missed a treatment because you couldn't afford it? What do you think of that?

When you have an infection, would you rather stay at home or be admitted to the hospital for IV antibiotics? Why? (maybe just a vote, then ask why?)

**Coping with CF**

Have you talked about how long you will live because of your CF? With who do you discuss this with?

How do you feel about how long you will live?

Do you think you act differently because of how long you might live?

Do you worry about dying? What are your worries?

Do you feel independent? What are some things that might interfere with your independence?

**Exclude unless time is OK**

Which treatments affect your daily life the most? Why?***

Prompt: Do these help your CF symptoms the most? If not, which ones do?

How often do you see a doctor? What types of things do you see the doctor for?***

**7. Closing**

Thank you very much for staying and talking with us. This discussion is part of a study on the effects of CF on people's daily activities and feelings about their health. In the next few months we'll be doing another survey of other people with CF to find out more about this. You've helped us to learn more about what kinds of things we should ask. You've been very helpful.

The researchers would like to have a little bit more information about you. I have a few questions that they would like you to answer on your own. Of course, this is voluntary and you do not have to do it. It should take about 15 minutes to complete.

<<Have participants complete the questionnaire>>

**Adolescent CF Patients Quality of life – Focus Group Discussion**

**1. Introduction**

Thank you for coming this morning. My name is Carlyn and this is Melinda who will be helping me today.

As you can see, we're taping this discussion so that we don't have to take notes. This discussion is anonymous – we won't be linking your full names with what you say in here – which means we want to use you first names only today, OK?

First, we have to be sure that all of you and your parents have had a chance to review the information about this project and have signed the required forms.

<<Check to see if all have signed consent forms.>>

You have been asked to come here today because we are interested in finding out about your daily activities, and the impact of cystic fibrosis on the quality of your life. We are talking to people with CF now so we can learn first-hand about your experiences and perceptions. Your input will help us to assess the quality of life of people with CF. The people who are running this research project will use the information we talk about today to put together a standard questionnaire that can be used in other settings.

Some of the things that we will be speaking about today may be sensitive topics for you, if you don't feel comfortable answering any questions, you don't have to answer it. Also, if you feel you want to leave you are free to do that too.

Let's begin by going around the table. I'd like you to tell us your first name.

Now I would like to discuss how CF impacts you in the things you do and how you feel.

**Link good day and name exchange to save time

**2. Daily Activities**

*General*

Describe a regular day for you. What do you do?

Do you ever have bad days? What are they like?

*Energy/Exercise*

Do you think you have less energy than people like you who don't have CF?

Can you keep up with your friends?

*Sleep*

Are you happy with the sleep that you get?

Does your CF interfere with your sleeping?

*Diet*

Do you have trouble eating as much as you should? Why? (probe:hard to fit in? money? physically unable?)

Do you like what you are supposed to eat? (probe: diet supplements)?

**3. Relationships**

How does having CF affect your relationships with your family? What about relationships with your friends at school?

Do you feel comfortable telling other people you have CF? How do you feel about having to explain all of the time to others how you are feeling?

**4. Body Image**

How does having CF make you feel about yourself? (probe: self-conscious?)

Do you try to hide things about your CF (probe: the way you hold your fingers, wearing baggy clothes to hide your weight)?

Are you concerned about your height or weight? Are other people more concerned about this than you?

**5. Coping with CF**

Have you talked with people about how long you will live because of your CF? (probe: family, doctor)

How do you feel about how long you will live?

Do you think you act differently because of how long you might live?

Do you worry about dying? What are your worries?

Do you feel independent? Does anything about CF affect your independence?

**6. Symptoms**

What conditions or symptoms are you limited by? How does each one limit you?

- shortness of breath/breathlessness
- coughing
- chest pains
- gas
- stomach cramps/aches
- headaches
- achy joints
- muscle pains

**7. Treatment burden**

How much time do you spend on your CF treatments? (probe: chest physio, nebulizations, and diet)?

Have you ever missed a treatment because you or your family couldn't afford it? Does this bother you?

When you have an infection, would you rather stay at home or be admitted to the hospital for IV antibiotics? Why? (go around the room and count hands then ask why)

**********exclude unless time allows

Which treatments affect your daily life the most? Why?

-Prompt: Do these treatments help your CF symptoms the most? If not, which ones do?

How often do you see a doctor? What things do you the doctor for?

**8. Closing**

Thank you very much for staying and talking with us. This discussion is part of a study on the effects of CF on people's daily activities and feelings about their health. In the next few months we'll be doing another survey of other people with CF to find out more about this. You've helped us to learn more about what kinds of things we should ask. You've been very helpful.

The researchers would like to have a little bit more information about you. I have a few questions that they would like you to answer on your own. Of course, this is voluntary and you do not have to do it. It should take about 15 minutes to complete.

## APPENDIX II

CONSENT FORMS

**Research Project:** **Quality of Life in Cystic Fibrosis Patients**
**Focus Group Discussion**

Dear Patient:

This consent form is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask.

The purpose of this research is to look at quality of life in our CF patients, to see if this is related to how sick or well a person is, how they are feeling, or how they do on pulmonary function tests. Also, we hope to look at quality of life overall for our patients to see if there are areas where additional services might be needed.

Basically, you have been asked to participate in a discussion with 6-8 other people with CF. The discussion will be lead by a person trained to lead discussion groups and will focus on what aspects of CF impact your quality of life. The session will last about 90 minutes and will take place in a classroom at the University of Alberta Hospital (address below). The discussion will be audiotaped. The investigators will use the issues raised in the group discussion to develop a questionnaire that can be used to measure how CF affects the quality of people's lives. The questionnaire will then be used in a second part of this study. You may or may not choose to participate in that part.

There are no known risks to participating. Your participation in this study will help to develop a questionnaire intended to measure of the health of people with CF. It also provides the clinic with overall information regarding the difficulties people like you encounter, so that the program may better serve people with CF.

The information collected will be kept confidential and your responses will not be shared with anyone outside of the clinic except the study investigators. During the group discussion, only first names will be used to indicate participants. Reports of the study findings will not identify any individual participants or families. A brief summary of findings will be sent to the CF Association for their newsletter.

You should not incur any costs related to participation in this study. Your parking costs will be reimbursed. Your signature on this form indicates that you have understood to your satisfaction the information regarding your participation in the research project and agree to participate as a subject. Please read and complete the forms beforehand and bring them to the session.

university hospital
University of Alberta Hospital Site
8440 - 112 Street
Edmonton, Alberta
Canada T6G 2B7
Tel (403) 492-8822

In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without jeopardizing your health care. Your continued participation should be as informed as your initial consent, so you should feel free to ask for further clarification or new information throughout your participation. If you have further questions, please contact: Dr. Neil Brown or Joan Tabak at 492-6745.

If you have concerns about any part of this study, contact the Capital Health Patient Concerns Office, the phone number is 474-8892. This office has no affiliation with study investigators.

A copy of this consent form will be given to you. Please keep it for your records and future reference.

The investigators will explain to you the research and your involvement, and will seek your ongoing cooperation throughout the project.

Thank you for your participation.

Investigators:

| | | |
|---|---|---|
| Dr. Neil Brown | University of Alberta | (403) 492-6745 |
| Dr. Peter Zuberbuhler | University of Alberta | (403) 492-6745 |
| Dr. Jeffrey Johnson | University of Alberta | (403) 492-9266 |
| Dr. Mark Montgomery | University of Calgary | (403) 229-7882 |

**Time:** **Saturday, November 7, 1998** **12:00 – 1:30 p.m.**

**Location:** **University of Alberta Hospital 8440 – 112 Street**
**Classroom A (2F1 – 01) (on the second floor of the hospital)**

**DON'T FORGET TO BRING YOUR SIGNED CONSENT FORM. THANK YOU.**

**Part 1 (to be completed by the Principal Investigator):**

Title of Project: **Quality of Life in Cystic Fibrosis Patients**

Principal Investigator(s): **Dr. Jeffrey Johnson** Phone Number(s): **492-9266**

Co-Investigator(s): **Dr. Peter Zuberbuhler** Phone Number(s): **492-6745**
**Dr. Neil Brown** **492-6745**

---

**Part 2 (to be completed by the research subject):**

Do you understand that you have been asked to be in a research study? Yes No

Have you read and received a copy of the attached information sheet? Yes No

Do you understand the benefits and risks involved in taking part in this research study? Yes No

Have you had an opportunity to ask questions and discuss this study? Yes No

Do you understand that you are free to withdraw from the study at any time, without having to give a reason and without affecting your future medical care? Yes No

Has the issue of confidentiality been explained to you, and do you understand who will have access to your medical records? Yes No

Do you want the investigator(s) to inform your family doctor that you are participating in this research study? Yes No

Who explained this study to you? _____

---

I agree to take part in this study: YES NO

_____ _____
(Name of Patient) (Signature of witness)

_____ _____
(Patient's Signature) (Signature of Investigator/Designee)

_____
(Date)

Capital Health

**REFERRAL HOSPITAL SYSTEM**
University of Alberta Hospital Site

**Research Project:** **Quality of Life in Cystic Fibrosis Patients**
**Focus Group Discussion**

**Dear Parent:**

This consent form is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask.

The purpose of this research is to look at quality of life in our CF patients. It is also to see if this is related to how sick or well a child is, how they are growing, or how they do on pulmonary function tests. Also, we hope to look at quality of life overall for our patients to see if there are areas where additional services might be needed.

Basically, your child has been asked to participate in a discussion with 6-8 other children with CF. Two discussion groups will be held. One group will be for children aged 8 to 11 years, with one parent. The other group will be children aged 12 to 17 years, without their parent. The discussion will be lead by a person trained to lead discussion groups and will focus on what aspects of CF impact the quality of your child's life. The session will last about 90 minutes and will take place in a classroom at the University of Alberta Hospital (address below). The discussion will be audiotaped. The investigators will use the issues raised in the group discussion to develop a questionnaire that can be used to measure how CF affects the quality of children's lives. The questionnaire will then be used in a second part of this study. You and your child may or may not choose to participate in that part.

There are no known risks to participating. Your participation in this study will help to develop a questionnaire intended to measure of the health of people with CF. It also provides the clinic with overall information regarding the difficulties children with CF encounter, so that the program may better serve people with CF.

The information collected will be kept confidential and your responses will not be shared with anyone outside of the clinic except the study investigators. During the group discussion, only first names will be used to indicate participants. Reports of the study findings will not identify any individual participants or families. A brief summary of findings will be sent to the CF Association for their newsletter.

You should not incur any costs related to participation in this study. Your parking costs will be reimbursed. Your signature on this form indicates that you have understood to your satisfaction the information regarding your participation in the research project and

university of Alberta hospital
University of Alberta Hospital Site
8440 - 112 Street
Edmonton, Alberta
Canada T6G 2B7
Tel: (403) 492-8822

agree to participate as a subject. You are also consenting for your child or teen to participate. Please read and complete the forms beforehand and bring them to the session.

In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without jeopardizing your health care. Your continued participation should be as informed as your initial consent, so you should feel free to ask for further clarification or new information throughout your participation. If you have further questions, please contact Dr. Peter Zuberbuhler or Joan Tabak at 492-6745.

If you have concerns about any part of this study, contact the Capital Health Patient Concerns Office, the phone number is 474-8892. This office has no affiliation with study investigators.

A copy of this consent form will be given to you. Please keep it for your records and future reference.

The investigators will explain to your child the research and his or her involvement, and will seek his or her ongoing cooperation throughout the project.

Thank you for your participation.

Investigators:

| | | |
|---|---|---|
| Dr. Peter Zuberbuhler | University of Alberta | (403) 492-6745 |
| Dr. Neil Brown | University of Alberta | (403) 492-6745 |
| Dr. Jeffrey Johnson | University of Alberta | (403) 492-9266 |
| Dr. Mark Montgomery | University of Calgary | (403) 229-7882 |

**Time:** **Saturday, November 7, 1998** **10:00 – 11:30 a.m.**

**Location:** **University of Alberta Hospital 8440 – 112 Street**
**Classroom A (2F1 – 01) (on the second floor of the hospital)**

**DON'T FORGET TO BRING YOUR SIGNED CONSENT FORM. THANK YOU.**

**Part 1 (to be completed by the Principal Investigator):**

Title of Project: **Quality of Life in Cystic Fibrosis Patients**

Principal Investigator(s): **Dr. Jeffrey Johnson** Phone Number(s): **492-9266**

Co-Investigator(s): **Dr. Peter Zuberbuhler** Phone Number(s): **492-6745**
**Dr. Neil Brown** **492-6745**

---

**Part 2 (to be completed by the research subject):**

Do you understand that you have been asked to be in a research study? Yes No

Have you read and received a copy of the attached information sheet? Yes No

Do you understand the benefits and risks involved in taking part in this research study? Yes No

Have you had an opportunity to ask questions and discuss this study? Yes No

Do you understand that you are free to withdraw from the study at any time, without having to give a reason and without affecting your future medical care? Yes No

Has the issue of confidentiality been explained to you, and do you understand who will have access to your medical records? Yes No

Do you want the investigator(s) to inform your family doctor that you are participating in this research study? Yes No

Who explained this study to you? _____

---

I agree to take part in this study: YES NO

_____ _____
(Child's name) (Name of Parent/Guardian)

_____ _____
(Child's Signature) (Parent/Guardian's Signature)

_____ _____
(Signature of Investigator/Designee) (Signature of witness)

_____
(Date)

CRHA
Calgary Regional Health Authority

**Research Project:** **Quality of Life in Cystic Fibrosis Patients**
**Focus Group Discussion**

Dear Parent:

This consent form is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask.

The purpose of this research is to look at quality of life in our CF patients. It is also to see if this is related to how sick or well a child is, how they are growing, or how they do on pulmonary function tests. Also, we hope to look at quality of life overall for our patients to see if there are areas where additional services might be needed.

Basically, your child has been asked to participate in a discussion with 6-8 other children with CF. Two discussion groups will be held. One group will be for children aged 8 to 11 years, with one parent. The other group will be children aged 12 to 17 years, without their parent. The discussion will be lead by a person trained to lead discussion groups and will focus on what aspects of CF impact the quality of your child's life. The session will last about 90 minutes and will take place in a room at the Alberta Children's Hospital (address below). The discussion will be audiotaped. The investigators will use the issues raised in the group discussion to develop a questionnaire that can be used to measure how CF affects the quality of children's lives. The questionnaire will then be used in a second part of this study. You and your child may or may not choose to participate in that part.

There are no known risks to participating. Your participation in this study will help to develop a questionnaire intended to measure of the health of people with CF. It also provides the clinic with overall information regarding the difficulties children with CF encounter, so that the program may better serve people with CF.

The information collected will be kept confidential and your responses will not be shared with anyone outside of the clinic except the study investigators. During the group discussion, only first names will be used to indicate participants. Reports of the study findings will not identify any individual participants or families. A brief summary of findings will be sent to the CF Association for their newsletter.

You should not incur any costs related to participation in this study. Your parking costs will be reimbursed. Your signature on this form indicates that you have understood to your satisfaction the information regarding your participation in the research project and agree to participate as a subject. You are also consenting for your child or teen to participate. Please read and complete the forms beforehand and bring them to the session.

1820 Richmond Road S.W., Calgary, Alberta T2T 5C7 Tel: (403) 229-7211 Fax: (403) 229-7221
*"Our community working together for excellence in health."*

In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without jeopardizing your health care. Your continued participation should be as informed as your initial consent, so you should feel free to ask for further clarification or new information throughout your participation. If you have further questions, please contact Dr. Mark Montgomery at 229-7882 or Kay Jamieson at 229-7319.

If you have concerns about any part of this study, contact the Office of Medical Bioethics at 220-7990. This office has no affiliation with study investigators.

A copy of this consent form will be given to you. Please keep it for your records and future reference.

The investigators will explain to your child the research and his or her involvement, and will seek his or her ongoing cooperation throughout the project.

Thank you for your participation.

Investigators:

| | | |
|---|---|---|
| Dr. Mark Montgomery | University of Calgary | (403) 229-7882 |
| Dr. Peter Zuberbuhler | University of Alberta | (403) 492-6745 |
| Dr. Neil Brown | University of Alberta | (403) 492-6745 |
| Dr. Jeffrey Johnson | University of Alberta | (403) 492-9266 |

**Time:** **Saturday, November 28, 1998 1:00 – 2:30 p.m.**

**You are also invited to come early and have lunch. 12:00 – 1:00 p.m.**

**Location:** **Alberta Children's Hospital 820 Richmond Road S.W.**
**Conference Room 2 (second floor of the hospital)**

**DON'T FORGET TO BRING YOUR SIGNED CONSENT FORM. THANK YOU.**

**Part 1 (to be completed by the Principal Investigator):**

Title of Project: **Quality of Life in Cystic Fibrosis Patients**

Principal Investigator(s): **Dr. Jeffrey Johnson** Phone Number(s): **492-9266**

Co-Investigator(s): **Dr. Mark Montgomery** Phone Number(s): **229-7882**

---

**Part 2 (to be completed by the research subject):**

| | | |
|---|---|---|
| Do you understand that you have been asked to be in a research study? | Yes | No |
| Have you read and received a copy of the attached information sheet? | Yes | No |
| Do you understand the benefits and risks involved in taking part in this research study? | Yes | No |
| Have you had an opportunity to ask questions and discuss this study? | Yes | No |
| Do you understand that you are free to withdraw from the study at any time, without having to give a reason and without affecting your future medical care? | Yes | No |
| Has the issue of confidentiality been explained to you, and do you understand who will have access to your medical records? | Yes | No |
| Do you want the investigator(s) to inform your family doctor that you are participating in this research study? | Yes | No |

Who explained this study to you? _____

---

I agree to take part in this study: YES NO

_____ _____

(Child's name) (Name of Parent/Guardian)

_____ _____

(Child's Signature) (Parent/Guardian's Signature)

_____ _____

(Signature of Investigator/Designee) (Signature of witness)

_____

(Date)

# APPENDIX III

## CLINICAL IMPACT QUESTIONNAIRES

## Quality of Life in Cystic Fibrosis - Adult Version

**Instructions.** Below are a number of statements about cystic fibrosis, its symptoms, and its impact on your daily life. For each statement, please circle one number for each set (1 to 5). The first set of numbers is to say how often you feel that statement happens or how often it concerns you. The second set of numbers is to say how important that thing is to you. For example, if you are short of breath only once and awhile, you might circle the first 3. But if shortness of breath is very important to you, then you might circle the second 5.

| EXAMPLE | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| a. shortness of breath | 1 | 2 | (3) | 4 | 5 | 1 | 2 | 3 | 4 | (5) |

Please provide answers for each statement, as best you can. There are no right or wrong answers. We are only interested in how you feel about each statement.

| A. Symptoms | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| 1. shortness of breath | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. wheezing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. chest pains | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. tightness in your chest | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. coughing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. producing sputum | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. voice changes | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. having a lot of gas | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. heartburn | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. stomach cramps | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. stomach aches | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. diarrhea | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. headaches | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. lightheadedness | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. achy joints | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. muscle pains | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. loss of appetite | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. sinus problems | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Quality of Life in Cystic Fibrosis - Adult Version**

| B. Having CF | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| 1. Having trouble falling asleep | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. Waking up at night because you were coughing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. Not feeling well-rested in the morning | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. Having difficulty taking a deep breath | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. Coughing during the day | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. Coughing up blood | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. Feeling like you are being forced to eat | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. Having trouble eating the amount of food you are supposed to | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. Having trouble eating the type of food you are supposed to | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. People asking you about your pills | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. Thinking about your weight | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. Thinking about your height | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. Thinking about the way your body looks | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. Feeling that your treatments take too much time | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. Stopping doing things with friends or family to do your treatments | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. Stopping doing things with friends or family because of your breathing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. Missing work or school because you were sick | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. Missing leisure activities because you were sick | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 19. Not being able to keep up with your friends | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 20. Not being able to keep up with your family | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 21. Participating in sports or excercise | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Quality of Life in Cystic Fibrosis - Adult Version**

| B. Having CF (cont') | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| 22. Not being able to run as far as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 23. Not being able to run as fast as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 24. Not being able to walk as fast as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 25. Not being able to climb stairs as fast as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 26. Having trouble carrying heavy things | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 27. Having less energy than your friends | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 28. Having trouble explaining what CF is | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 29. Avoiding telling people you have CF | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 30. Trying to hide the fact that you have CF | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 31. Using your CF as an excuse not to do things | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 32. Worrying about not being able to afford treatments | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 33. Worrying about not being able to work and/or keep your job | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 34. Worrying about others (parents, spouse, kids) | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 34. Having your spouse or others worry about you | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 35. Thinking about how much your CF affects your family | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 36. Feeling like others treat you differently | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 37. Being nagged or reminded about treatments or physiotherapy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 38. Having enough family help and support | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 40. Worrying about how long you will live | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 41. Worrying about having relationships | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 42. Worrying about having children | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Quality of Life in Cystic Fibrosis - Adult Version**

| C. Feelings | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| 1. Short-tempered | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. Full of energy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. Tired | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. Frustrated | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. Embarrassed | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. Self-conscious | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. Angry | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. Sad | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. Frightened | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. Worried | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. Grouchy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. Alone (All by yourself) | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. Dependent on others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. Weak | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. Sick | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. Happy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. Cheerful | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. Independent | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 19. Optimistic | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Thank you for taking the time to complete this questionnaire.**

Do you have any comments on these questions? Did we use the right words? Was it easy to understand? Are there any symptoms, activities, or feelings that are important to you, but were not included here?

_____

_____

_____

_____

_____

## Quality of Life in Cystic Fibrosis - Adolescent Version

**Instructions.** Below are a number of statements about cystic fibrosis, its symptoms, and its impact on your daily life. For each statement, please circle one number for each set (1 to 5). The first set of numbers is to say how often you feel that statement happens or how often it concerns you. The second set of numbers is to say how important that thing is to you. For example, if you are short of breath only once and awhile, you might circle the first 3. But if shortness of breath is very important to you, then you might circle the second 5.

| EXAMPLE | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| a. shortness of breath | 1 | 2 | (3) | 4 | 5 | 1 | 2 | 3 | 4 | (5) |

Please provide answers for each statement, as best you can. There are no right or wrong answers. We are only interested in how you feel about each statement.

| A. Symptoms | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| 1. shortness of breath | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. wheezing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. chest pains | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. tightness in your chest | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. coughing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. producing sputum | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. voice changes | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. having a lot of gas | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. heartburn | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. stomach cramps | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. stomach aches | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. diarrhea | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. headaches | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. lightheadedness | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. achy joints | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. muscle pains | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. loss of appetite | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. sinus problems | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Quality of Life in Cystic Fibrosis - Adolescent Version**

| B. Having CF | How Frequent? Rare | | | | Very often | How Important? Not at all | | | | Very |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Having trouble falling asleep | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. Waking up at night because you were coughing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. Not feeling well-rested in the morning | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. Having difficulty taking a deep breath | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. Coughing during the day | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. Coughing up blood | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. Feeling like you are being forced to eat | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. Having trouble eating the amount of food you are supposed to | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. Having trouble eating the type of food you are supposed to | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. People asking you about your pills | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. Thinking about your weight | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. Thinking about your height | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. Thinking about the way your body looks | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. Feeling that your treatments take too much time | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. Having to stop doing things with friends to do your treatments | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. Having to stop doing things with friends because of your breathing | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. Missing school because you were sick | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. Missing after-school activities because you were sick | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 19. Participating in gym class or sports at school | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 20. Participating in sports or excercise outside of school | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 21. Not being able to keep up with your friends | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Quality of Life in Cystic Fibrosis - Adolescent Version**

| B. Having CF (cont') | How Frequent? | | | | | How Important? | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rare | | | | Very often | Not at all | | | | Very |
| 22. Not being able to run as far as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 23. Not being able to run as fast as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 24. Not being able to walk as fast as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 25. Not being able to climb stairs as fast as others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 26. Having trouble carrying heavy things | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 27. Having less energy than your friends | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 28. Having trouble explaining what CF is | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 29. Avoiding telling people you have CF | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 30. Trying to hide the fact that you have CF | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 31. Using your CF as an excuse not to do things | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 32. Keeping your parents busy with your treatments or appointments. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 33. Making your parents miss work | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 34. Having your parents or others worry about you | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 35. Thinking about how much your CF affects your family | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 36. Worrying about how long you will live | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 37. Feeling like others treat you differently | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 38. Worrying about having a boyfriend or girlfriend | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 39. Being nagged or reminded about treatments or physiotherapy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 40. Having friends who are supportive of you doing your treatments | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 42. Having a family that is supportive of you doing your treatments | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Quality of Life in Cystic Fibrosis - Adolescent Version**

| C. Feelings | How Frequent? Rare | | | | Very often | How Important? Not at all | | | | Very |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Short-tempered | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. Full of energy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. Tired | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. Frustrated | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. Embarrassed | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. Self-conscious | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. Angry | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. Sad | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. Frightened | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. Worried | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. Grouchy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. Alone (All by yourself) | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. Dependent on others | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. Weak | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. Sick | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. Happy | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. Cheerful | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. Independent | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 19. Optimistic | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Thank you for taking the time to complete this questionnaire.**

Do you have any comments on these questions? Did we use the right words? Was it easy to understand? Are there any symptoms, activities, or feelings that are important to you, but were not included here?

_____

_____

_____

_____

_____

## APPENDIX IV

ADULT CYSTIC FIBROSIS QUESTIONNAIRE (ACFQ)
AND
TEEN CYSTIC FIBROSIS QUESTIONNAIRE (TCFQ)

# ADULT CYSTIC FIBROSIS QUALITY OF LIFE QUESTIONNAIRE

1. In general, would you say your health is:

(please circle one)

| | |
|---|---|
| Excellent | 1 |
| Very good | 2 |
| Good | 3 |
| Fair | 4 |
| Poor | 5 |

2. How bothered have you been during the last two weeks by:

(please circle one)

| | Extremely bothered | Quite bothered | Somewhat bothered | Hardly bothered | Not bothered |
|---|---|---|---|---|---|
| a) Coughing | 1 | 2 | 3 | 4 | 5 |
| b) Shortness of breath | 1 | 2 | 3 | 4 | 5 |
| c) Sinus problems | 1 | 2 | 3 | 4 | 5 |
| d) Tightness in your chest | 1 | 2 | 3 | 4 | 5 |
| e) Producing sputum | 1 | 2 | 3 | 4 | 5 |
| f) Wheezing | 1 | 2 | 3 | 4 | 5 |

3. How bothered have you been during the last two weeks by:

(please circle one)

| | Extremely bothered | Quite bothered | Somewhat bothered | Hardly bothered | Not bothered |
|---|---|---|---|---|---|
| a) Heartburn | 1 | 2 | 3 | 4 | 5 |
| b) Stomach aches or cramps | 1 | 2 | 3 | 4 | 5 |
| c) Having a lot of gas | 1 | 2 | 3 | 4 | 5 |
| d) Diarrhea | 1 | 2 | 3 | 4 | 5 |
| e) Loss of appetite | 1 | 2 | 3 | 4 | 5 |

4. How bothered have you been during the last two weeks by:

(please circle one)

| | Extremely bothered | Quite bothered | Somewhat bothered | Hardly bothered | Not bothered |
|---|---|---|---|---|---|
| a) Headaches | 1 | 2 | 3 | 4 | 5 |
| b) Achy joints | 1 | 2 | 3 | 4 | 5 |
| c) Chest pains | 1 | 2 | 3 | 4 | 5 |
| d) Muscle pains | 1 | 2 | 3 | 4 | 5 |

5. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Cough during the day | 1 | 2 | 3 | 4 | 5 |
| b) Have difficulty taking a deep breath | 1 | 2 | 3 | 4 | 5 |
| c) Wake up at night because you were coughing | 1 | 2 | 3 | 4 | 5 |
| d) Cough up blood | 1 | 2 | 3 | 4 | 5 |

6. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Miss work/school because you were sick | 1 | 2 | 3 | 4 | 5 |
| b) Miss leisure activities because you were sick | 1 | 2 | 3 | 4 | 5 |
| c) Stop doing things with friends/family due to your breathing | 1 | 2 | 3 | 4 | 5 |
| d) Stop doing things with friends/family to do your treatments | 1 | 2 | 3 | 4 | 5 |
| e) Feel that your treatments took too much time | 1 | 2 | 3 | 4 | 5 |

7. In general, how often during the last two weeks did you feel:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) That you had enough family help and support | 1 | 2 | 3 | 4 | 5 |
| b) That you could keep up with your family | 1 | 2 | 3 | 4 | 5 |
| c) That you could keep up with your friends | 1 | 2 | 3 | 4 | 5 |
| d) Nagged/reminded about treatments or physio | 1 | 2 | 3 | 4 | 5 |
| e) That others treated you differently | 1 | 2 | 3 | 4 | 5 |
| f) You avoided telling people you have CF | 1 | 2 | 3 | 4 | 5 |

8. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Have less energy than your friends | 1 | 2 | 3 | 4 | 5 |
| b) Feel well-rested in the mornings | 1 | 2 | 3 | 4 | 5 |
| c) Have trouble falling asleep | 1 | 2 | 3 | 4 | 5 |

9. In general, how often during the last two weeks did you worry about:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) How much CF affects other people (parents, spouse, kids) | 1 | 2 | 3 | 4 | 5 |
| b) Other people (parents, spouse, kids) worrying about you | 1 | 2 | 3 | 4 | 5 |
| c) How long you will live | 1 | 2 | 3 | 4 | 5 |
| d) Having relationships | 1 | 2 | 3 | 4 | 5 |
| e) Having children | 1 | 2 | 3 | 4 | 5 |
| f) Not being able to work or keep your job | 1 | 2 | 3 | 4 | 5 |
| g) Not being able to afford treatments | 1 | 2 | 3 | 4 | 5 |
| h) Your weight | 1 | 2 | 3 | 4 | 5 |
| i) The way your body looks | 1 | 2 | 3 | 4 | 5 |

10. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Have trouble eating the amount of food you are supposed to | 1 | 2 | 3 | 4 | 5 |
| b) Have trouble eating the type of food you are supposed to | 1 | 2 | 3 | 4 | 5 |
| c) Feel like you were being forced to eat | 1 | 2 | 3 | 4 | 5 |

11. In general, how often during the last two weeks were you able to:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Participate in sports or exercise | 1 | 2 | 3 | 4 | 5 |
| b) Carry heavy things | 1 | 2 | 3 | 4 | 5 |
| c) Run as far as others | 1 | 2 | 3 | 4 | 5 |
| d) Run as fast as others | 1 | 2 | 3 | 4 | 5 |
| e) Walk as fast as others | 1 | 2 | 3 | 4 | 5 |
| f) Climb stairs as fast as others | 1 | 2 | 3 | 4 | 5 |

12. In general, how often during the last two weeks did you feel:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Independent | 1 | 2 | 3 | 4 | 5 |
| b) Optimistic | 1 | 2 | 3 | 4 | 5 |
| c) Happy / Cheerful | 1 | 2 | 3 | 4 | 5 |
| d) Short-tempered | 1 | 2 | 3 | 4 | 5 |
| e) Frustrated | 1 | 2 | 3 | 4 | 5 |
| f) Self-conscious | 1 | 2 | 3 | 4 | 5 |
| g) Dependent on others | 1 | 2 | 3 | 4 | 5 |
| h) Sad | 1 | 2 | 3 | 4 | 5 |
| i) Alone | 1 | 2 | 3 | 4 | 5 |
| j) Angry | 1 | 2 | 3 | 4 | 5 |
| k) Frightened | 1 | 2 | 3 | 4 | 5 |

# TEEN CYSTIC FIBROSIS QUALITY OF LIFE QUESTIONNAIRE

1. In general, would you say your health is:

| | (please circle one) |
|---|---|
| Excellent | 1 |
| Very good | 2 |
| Good | 3 |
| Fair | 4 |
| Poor | 5 |

2. How bothered have you been during the last two weeks by:

(please circle one)

| | Extremely bothered | Quite bothered | Somewhat bothered | Hardly bothered | Not bothered |
|---|---|---|---|---|---|
| a) Coughing | 1 | 2 | 3 | 4 | 5 |
| b) Sinus problems | 1 | 2 | 3 | 4 | 5 |
| c) Shortness of breath | 1 | 2 | 3 | 4 | 5 |
| d) Producing sputum | 1 | 2 | 3 | 4 | 5 |
| e) Tightness in your chest | 1 | 2 | 3 | 4 | 5 |
| f) Wheezing | 1 | 2 | 3 | 4 | 5 |

3. How bothered have you been during the last two weeks by:

(please circle one)

| | Extremely bothered | Quite bothered | Somewhat bothered | Hardly bothered | Not bothered |
|---|---|---|---|---|---|
| a) Stomach aches or cramps | 1 | 2 | 3 | 4 | 5 |
| b) Having a lot of gas | 1 | 2 | 3 | 4 | 5 |
| c) Loss of appetite | 1 | 2 | 3 | 4 | 5 |
| d) Heartburn | 1 | 2 | 3 | 4 | 5 |
| e) Diarrhea | 1 | 2 | 3 | 4 | 5 |

4. How bothered have you been during the last two weeks by:

(please circle one)

| | Extremely bothered | Quite bothered | Somewhat bothered | Hardly bothered | Not bothered |
|---|---|---|---|---|---|
| a) Headaches | 1 | 2 | 3 | 4 | 5 |
| b) Achy joints | 1 | 2 | 3 | 4 | 5 |
| c) Muscle pains | 1 | 2 | 3 | 4 | 5 |
| d) Chest pains | 1 | 2 | 3 | 4 | 5 |

5. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Cough during the day | 1 | 2 | 3 | 4 | 5 |
| b) Have difficulty taking a deep breath | 1 | 2 | 3 | 4 | 5 |
| c) Wake up at night because of coughing | 1 | 2 | 3 | 4 | 5 |
| d) Cough up blood | 1 | 2 | 3 | 4 | 5 |

6. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Miss school because you were sick | 1 | 2 | 3 | 4 | 5 |
| b) Miss after-school activities because you were sick | 1 | 2 | 3 | 4 | 5 |
| c) Stop doing things with friends because of your breathing | 1 | 2 | 3 | 4 | 5 |
| d) Stop doing things with friends to do your treatments | 1 | 2 | 3 | 4 | 5 |
| e) Feel that your treatments took too much time | 1 | 2 | 3 | 4 | 5 |

7. In general, how often do you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Avoid telling people you have CF | 1 | 2 | 3 | 4 | 5 |
| b) Have trouble explaining what CF is | 1 | 2 | 3 | 4 | 5 |
| c) Try to hide the fact that you have CF | 1 | 2 | 3 | 4 | 5 |

8. In general, how often during the last two weeks did you feel:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) That your family was supportive of your treatments | 1 | 2 | 3 | 4 | 5 |
| b) That your friends were supportive of your treatments | 1 | 2 | 3 | 4 | 5 |
| c) Nagged/reminded about treatments or physio | 1 | 2 | 3 | 4 | 5 |
| d) That you could keep up with your friends | 1 | 2 | 3 | 4 | 5 |
| e) That others treated you differently | 1 | 2 | 3 | 4 | 5 |
| f) Bothered that people asked about your pills | 1 | 2 | 3 | 4 | 5 |

9. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Have less energy than your friends | 1 | 2 | 3 | 4 | 5 |
| b) Feel well-rested in the mornings | 1 | 2 | 3 | 4 | 5 |
| c) Have trouble falling asleep | 1 | 2 | 3 | 4 | 5 |

10. In general, how often during the last two weeks did you worry about:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) The way your body looks | 1 | 2 | 3 | 4 | 5 |
| b) Your height | 1 | 2 | 3 | 4 | 5 |
| c) Your weight | 1 | 2 | 3 | 4 | 5 |
| d) Your parents or others worrying about you | 1 | 2 | 3 | 4 | 5 |
| e) How long you will live | 1 | 2 | 3 | 4 | 5 |
| f) Having boyfriends/girlfriends | 1 | 2 | 3 | 4 | 5 |
| g) Keeping your parents busy with your treatments and appointments | 1 | 2 | 3 | 4 | 5 |
| h) How much CF affects your family | 1 | 2 | 3 | 4 | 5 |

11. In general, how often during the last two weeks did you:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Have trouble eating the amount of food you are supposed to | 1 | 2 | 3 | 4 | 5 |
| b) Have trouble eating the type of food you are supposed to | 1 | 2 | 3 | 4 | 5 |
| c) Feel like you were being forced to eat | 1 | 2 | 3 | 4 | 5 |

12. In general, how often during the last two weeks were you able to:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Participate in sports or exercise outside of school | 1 | 2 | 3 | 4 | 5 |
| b) Participate in gym/sports in school | 1 | 2 | 3 | 4 | 5 |
| c) Run as far as others | 1 | 2 | 3 | 4 | 5 |
| d) Run as fast as others | 1 | 2 | 3 | 4 | 5 |
| e) Carry heavy things | 1 | 2 | 3 | 4 | 5 |

13. In general, how often during the last two weeks did you feel:

(please circle one)

| | All of the time | Most of the time | Some of the time | Hardly any of the time | None of the time |
|---|---|---|---|---|---|
| a) Happy / Cheerful | 1 | 2 | 3 | 4 | 5 |
| b) Optimistic | 1 | 2 | 3 | 4 | 5 |
| c) Independent | 1 | 2 | 3 | 4 | 5 |
| d) Frustrated | 1 | 2 | 3 | 4 | 5 |
| e) Self-conscious | 1 | 2 | 3 | 4 | 5 |
| f) Short-tempered | 1 | 2 | 3 | 4 | 5 |
| g) Embarrassed | 1 | 2 | 3 | 4 | 5 |
| h) Sad | 1 | 2 | 3 | 4 | 5 |
| i) Angry | 1 | 2 | 3 | 4 | 5 |
| j) Frightened | 1 | 2 | 3 | 4 | 5 |
| k) Alone | 1 | 2 | 3 | 4 | 5 |

## APPENDIX V

SCORING GUIDE

## ITEM SCORES

Each item is scored using the response option that was given. For example, for question (1) if the respondent answered '3', the raw item score would be three.

The negatively worded questions must be recoded so that a higher score indicates better health. The following formula is used: [6 - x = score]. These items are:
7a, 7b, 7c, 8b, 11a, 11b, 11c, 11d, 11e, 11f, 12a, 12b, and 12c.

For example, for question (7a) if the respondent answered '1', the score would be five (6 - 1 = 5). Once the items are recoded, relabel them:
7ar, 7br, 7cr, 8br, 11ar, 11br, 11cr, 11dr, 11er, 11fr, 12ar, 12br, and 12cr.

## SCALE SCORES

Items are then grouped into ten scales (or domains). The raw scores for each scale are calculated by adding the scores for individual items as follows:

1) General (GH)
   1

2) Physical Function (PF)
   7br + 7cr + 8a + 8br + 8c + 11ar + 11br + 11cr + 11dr + 11er + 11fr

3) Symptoms – Respiratory (SX-R)
   2a + 2b + 2c + 2d + 2e + 2f + 5a + 5b + 5c + 5d

4) Symptoms – GI (SX-G)
   3a + 3b + 3c + 3d + 3e

5) Symptoms – Pain (SX-P)
   4a + 4b + 4c + 4d

6) Treatment Burden (TXB)
   6d + 6e + 7d + 9g + 10a + 10b + 10c

7) Social Role (SR)
   6a + 6b + 6c + 7ar + 7e

8) Worry – Body Image / Awareness (W-BIA)
   7f + 9c + 9h + 9i

9) Worry – Social Interactions (W-SI)
   9a + 9b + 9d + 9e + 9f

10) Emotional (EM)
12ar + 12br + 12cr + 12d + 12e + 12f + 12g + 12h + 12i + 12j + 12k

The scales are then prorated to be out of 100 to facilitate their interpretation. For question (1), the intervals within the ordinal scale have not been found to be equal, and are, therefore, converted based on Thurstone Method of Equal-Appearing Intervals (Ware et al., 1993).

1) General (GH)
1 = 100
2 = 84
3 = 61
4 = 25
5 = 0

The general formula for prorating the remainder of the scales is:
[(raw score – minimum score) / (maximum - minimum) * 100].

2) Physical Function (PF)
(raw score – 11) / (55 – 11) * 100

3) Symptoms – Respiratory (SX-R)
(raw score – 10) / (50 – 10) * 100

4) Symptoms – GI (SX-G)
(raw score – 5) / (25 – 5) * 100

5) Symptoms – Pain (SX-P)
(raw score – 4) / (20 – 4) * 100

6) Treatment Burden (TXB)
(raw score – 7) / (35 – 7) * 100

7) Social Role (SR)
(raw score – 5) / (25 – 5) * 100

8) Worry – Body Image / Awareness (W-BIA)
(raw score – 4) / (20 – 4) * 100

9) Worry – Social Interactions (W-SI)
(raw score – 5) / (25 – 5) * 100

10) Emotional (EM)
(raw score – 11) / (55 – 11) * 100

## ITEM SCORES

Each item is scored using the response option that was given. For example, for question (1) if the respondent answered '3', the raw item score would be three.

The negatively worded questions must be recoded so that a higher score indicates better health. The following formula is used: [6 - x = score]. These items are:

8a, 8b, 8d, 9b, 12a, 12b, 12c, 12d, 12e, 13a, 13b, and 13c.

For example, for question (8a) if the respondent answered '1', the score would be five (6 - 1 = 5). Once the items are recoded, relabel them

8ar, 8br, 8dr, 9br, 12ar, 12br, 12cr, 12dr, 12er, 13ar, 13br, and 13cr.

## SCALE SCORES

Items are then grouped into ten scales (or domains). The raw scores for each scale are calculated by adding the scores for individual items as follows:

1) General (GH)
   1

2) Physical Function (PF)
   8dr + 9a + 9br + 9c + 12ar + 12br + 12cr + 12dr + 12er

3) Symptoms – Respiratory (SX-R)
   2a + 2b + 2c + 2d + 2e + 2f + 5a + 5b + 5c + 5d

4) Symptoms – GI (SX-G)
   3a + 3b + 3c + 3d + 3e

5) Symptoms – Pain (SX-P)
   4a + 4b + 4c + 4d

6) Treatment Burden (TXB)
   6d + 6e + 8c + 11a + 11b + 11c

7) Social Role (SR)
   6a + 6b + 6c + 8ar + 8br + 8e + 8f

8) Worry – Body Image / Awareness (W-BIA)
   7a + 7b + 7c + 10a + 10b + 10c

9) Worry – Social Interactions (W-SI)
   10d + 10e + 10f + 10g + 10h

10) Emotional (EM)
13ar + 13br + 13cr + 13d + 13e + 13f + 13g + 13h + 13i + 13j + 13k

The scales are then prorated to be out of 100 to facilitate their interpretation. For question (1), the intervals within the ordinal scale have not been found to be equal, and are, therefore, converted based on Thurstone Method of Equal-Appearing Intervals (Ware et al., 1993).

1) General (GH)
1 = 100
2 = 84
3 = 61
4 = 25
5 = 0

The general formula for prorating the remainder of the scales is:
[(raw score – minimum score) / (maximum - minimum) * 100].

2) Physical Function (PF)
(raw score – 9) / (45 – 9) * 100

3) Symptoms – Respiratory (SX-R)
(raw score – 10) / (50 – 10) * 100

4) Symptoms – GI (SX-G)
(raw score – 5) / (25 – 5) * 100

5) Symptoms – Pain (SX-P)
(raw score – 4) / (20 – 4) * 100

6) Treatment Burden (TXB)
(raw score – 6) / (30 – 6) * 100

7) Social Role (SR)
(raw score – 7) / (35 – 7) * 100

8) Worry – Body Image / Awareness (W-BIA)
(raw score – 6) / (30 – 6) * 100

9) Worry – Social Interactions (W-SI)
(raw score – 5) / (25 – 5) * 100

10) Emotional (EM)
(raw score – 11) / (55 – 11) * 100

## APPENDIX VI

INTERVIEWER GUIDE

## ADULT / TEEN CYSTIC FIBROSIS QUALITY OF LIFE QUESTIONNAIRES

### INTERVIEWER INSTRUCTIONS

**Please read through the instructions before administering the questionnaire. It is important to follow certain procedures during the interview to ensure that complete and accurate information is obtained. It is also important to make the participants feel comfortable and relaxed while being interviewed.**

Questionnaire Administration Tips

1. **Ask the questions exactly as they are worded in the questionnaire and in the order specified.** Do not skip words or try to simplify the questions. Do not paraphrase or revise the questions.

2. **Never help the patient choose an answer.** Initially some patients may feel as if the questionnaire is some kind of test. They will look to you for approval, to see if they are doing it 'right'. Of course, there are no right answers; the patients are simply supposed to answer the questions as they understand them and to pick the option that they think best expresses how they have been feeling. Although it is natural to want to help them, this will destroy the validity of the questionnaire. The appropriate answer to the patients' questions would be something like: "There's no right answer, you pick whatever number you think best indicates how bothered you have been during the last two weeks by coughing."

3. **Be neutral in response to the patient's answer.** While again it is natural to express sympathy or empathy if the patient tells you they are extremely bothered by one of the symptoms, you must be careful that nothing in your words or manner implies surprise, sympathy, approval, or disapproval of the patient's answers.

4. **Ensure that patients understand the response options and that they give only one response per question.** Before asking the questions, explain what the coloured cards are for (see below). Remind patients that they are to choose only one option and give the number (i.e. '1' or 'extremely') not a lengthy word response. To further avoid confusion, hand the patient the appropriate coloured card for each question, taking it back when it is no longer required.

5. **Repeat the question if the patient seems unclear on its meaning.** If there is a problem of understanding, simply repeat the question a second time. If the patient is still unclear and says something like, "What do you mean by bothered by coughing?", the appropriate answer is, "Whatever it means to you". Do nof reword the question in an attempt to explain it to the patient.

Interview Steps:

a. Explain to the participants why they are being interviewed. For example, "Thank you for taking the time to participate in this study. Right now I am going to ask you some questions about having CF and how it affects your daily life. The answers are anonymous and will be grouped together with other people's answers in the study. These answers will help us learn more about how CF affects people's quality of life. Please answer the questions as best you can. There are no right or wrong answers."

b. Explain how the response cards work. For example, place the blue card in front of them and say "The numbers 1 through 5 represent all degrees of bother. For example, 1 represents extremely bothered and 5 represents not bothered and 2, 3, and 4 represent the possibilities in between. For certain questions you will be asked how much something bothers you and you will pick one of these numbers." Do the same for the other two cards.

c. Start asking the questions. For each question, hand the appropriate response card to the patient. (The colour will be indicated on the scoring sheet.) Read the question using the words provided. Circle the response on the answer sheet. Take back the response card, if not needed for the next question.

d. Thank the participant for their help in this important study and for taking the time to answer the questions.

Example, question 1:

[Put yellow card in front of patient.]
"In general, would you say your health is excellent, very good, good, fair, or poor"
[Circle number on answer sheet that corresponds with their answer. Take yellow card away.]

Example, question 2 (a):

[Put blue card in front of patient.]
"How bothered have you been during the last two weeks by coughing? Extremely bothered, quite bothered, somewhat bothered, hardly bothered, or not bothered."
[Circle number on answer sheet that corresponds with their answer. Go on to question 2 (b).]

## APPENDIX VII

EQ-5D QUESTIONNAIRE

Patient # _____ Date _____
Initials _____

**Please indicate which statement best describes your own health state today by placing a checkmark in one box for each group below.**

Mobility

- I have no problems in walking about ☐
- I have some problems in walking about ☐
- I am confined to bed ☐

Self-Care

- I have no problems with self-care ☐
- I have some problems with washing or dressing myself ☐
- I am unable to wash or dress myself ☐

Usual Activities

- I have no problems with performing my usual activities (e.g. work, study, housework, family or leisure activities) ☐
- I have some problems with performing my usual activities ☐
- I am unable to perform my usual activities ☐

Pain/Discomfort

- I have no pain or discomfort ☐
- I have moderate pain or discomfort ☐
- I have extreme pain or discomfort ☐

Anxiety/Depression

- I am not anxious or depressed ☐
- I am moderately anxious or depressed ☐
- I am extremely anxious or depressed ☐

---

Compared with my general level of health over the past 12 months, my health state today is:

PLEASE CHECK ONE BOX

- Better ☐
- Much the same ☐
- Worse ☐

CF QOL – EQ-5D

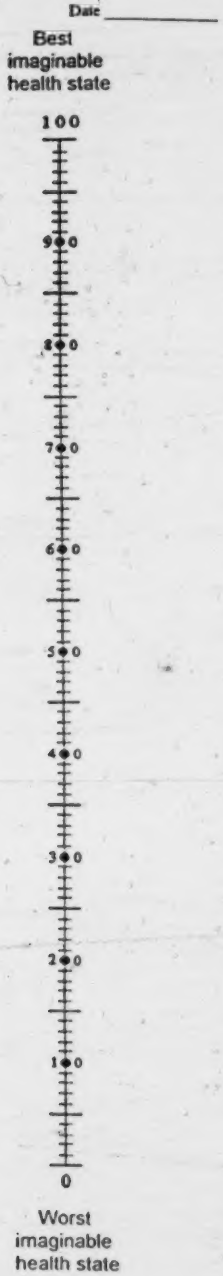
Patient # _____
Initials _____

Date _____

To help people say how good or bad their health is, we have drawn a scale (like a thermometer) on which the best state you can imagine is marked by 100 and the worst state you can imagine is marked by 0.

We would like you to indicate on this scale how good or bad your own health is today. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your current health state is.

Your own health state today




CF QOL – EQ-5D

## APPENDIX VIII

SF-12 QUESTIONNAIRE

Patient # _____ Date _____
Initials _____

## SF-12 Health Survey

**INSTRUCTIONS:** This questionnaire asks for your views about your health. This information will help keep track of how you feel and how well you are able to do you usual activities.

Please answer every question by marking one box. If you are unsure about how to answer, please give the best answer you can.

1. In general, would you say your health is:

| ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|
| Excellent | Very good | Good | Fair | Poor |

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

| | | Yes, Limited A Lot | Yes, Limited A Little | No, Not Limited At All |
|---|---|---|---|---|
| 2. | Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf | ☐ | ☐ | ☐ |
| 3. | Climbing several flights of stairs | ☐ | ☐ | ☐ |

During the past week, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

| | | Yes | No |
|---|---|---|---|
| 4. | Accomplished less than you would like | ☐ | ☐ |
| 5. | Were limited in the kind of work or other activities | ☐ | ☐ |

During the past week, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

| | | Yes | No |
|---|---|---|---|
| 6. | Accomplished less than you would like | ☐ | ☐ |
| 7. | Didn't do work or other activities as carefully as usual | ☐ | ☐ |

Copyright 1994 The Health Institute;
New England Medical Center.
All rights reserved.
(SF-12 Standard US Version 1.0)

Patient # _____ Date _____
Initials _____

8. During the past week, how much did pain interfere with your normal work (including both work outside the home and housework)?

| ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|
| **Not at all** | **A little bit** | **Moderately** | **Quite a bit** | **Extremely** |

These questions are about how you feel and how things have been with you during the past week. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past week -

| | | All of the Time | Most of the Time | A Good Bit of the Time | Some of the Time | A Little of the Time | None of the Time |
|---|---|---|---|---|---|---|---|
| 9. | Have you felt calm and peaceful? | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 10. | Did you have a lot of energy? | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11. | Have you felt downhearted and blue? | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

12. During the past week, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

| ☐ | ☐ | ☐ | ☐ | ☐ |
|---|---|---|---|---|
| **All of the time** | **Most of the time** | **Some of the time** | **A little of the time** | **None of the time** |

Copyright 1994 The Health Institute;
New England Medical Center.
All rights reserved.
(SF-12 Standard US Version 1.0)

## APPENDIX IX

### CLINICAL DATA ABSTRACTION FORM

## CLINIC DATA COLLECTION FORM

**Clinic Date** ____/____/____

**Patient #** ____/____/____/____ **Initials** ____/____/____

Sick at time of visit? Y / N

- ❑ Pulmonary symptoms
- ❑ GI symptoms
- ❑ Other _____

Weight _____ lbs / kg Height _____ cm / ft

Drug therapy

- ❑ rhDNase
- ❑ antibiotics
- ❑ oxygen
- ❑ enzymes
- ❑ other _____

Spirometry _____ (date)

- $FEV_1$ _____
- FVC _____
- $FEF_{25-75}$ _____

Walk test _____ $O_2$ saturation (before) _____

$O_2$ saturation (after) _____

NIH score _____

Comments _____

CF QOL Clinical Testing

## CHART ABSTRACTION FORM

**Date** ____/___/____

**Patient #** ___/___/___/___ **Initials** ____/___/____

Past $FEV_1$ _____ _____ (date)

_____ _____ (date)

_____ _____ (date)

Bacteria
- ❑ Pseudomonas aeruginosa
- ❑ Burkolderia cepacia
- ❑ Staphylococcus aureus
- ❑ Other

Comments _____

_____

## APPENDIX X

NIH SCORING FORM

Patient # _____
Initials _____

## NIH SCORING SHEET

Date _____

| | POINTS | MAX. | SCORE |
|---|---|---|---|
| **I. Pulmonary** | | | |
| A. X-ray | | 17 | |
| 1. Minimal accentuation of pulmonary markings | 1-3 | | |
| 2. Increased pulmonary markings; mild overaeration, atelectasis, and/or mucus plugging | 4-6 | | |
| 3. Moderate overaeration, fibrosis, atelectasis, and/or mucus plugging; early cyst formation | 7-10 | | |
| 4. Severe overaeration; extensive fibrosis and cyst formation, pulmonary obstruction, bronchiectasis | 11-13 | | |
| 5. Acute infiltrate | 1-4 | | |
| B. Pulmonary function tests | | 17 | |
| 1. Vital capacity (VC) less than 90% predicted | 1 | | |
| less than 80% predicted | 3 | | |
| less than 70% predicted | 5 | | |
| less than 60% predicted | 7 | | |
| less than 50% predicted | 9 | | |
| 2. $FEV_1$ less than 70% of total VC | 1 | | |
| less than 66% of total VC | 2 | | |
| less than 58% of total VC | 4 | | |
| less than 50% of total VC | 6 | | |
| less than 42% of total VC | 8 | | |
| C. Pulmonary exacerbation requiring intensive therapy | | 5 | |
| 1. Past 3 months | 5 | | |
| 2. Past year | 3 | | |
| D. Pneumothorax | | 5 | |
| 1. Past 6 months or recurrent | 5 | | |
| 2. Ever | 3 | | |
| E. Hemoptysis (omit if none since pulmonary surgery) | | 7 | |
| 1. Massive (a) past 6 months | 7 | | |
| (b) more than 6 months ago | 4 | | |
| 2. Small amount in past year | 1-3 | | |
| F. Pulmonary surgery (any restriction) | 2-7 | 7 | |
| G. Cor pulmonale | 3-5 | 5 | |
| H. Physical examination of lungs | 1-9 | 9 | |
| I. Sputum production and/or cough | 1-3 | 3 | |
| TOTAL PULMONARY | | 75 | _____ |
| **II. General** | | | |
| A. Weight | | 6 | |
| 1. Poor appetite | 1-2 | | |
| 2. Less than third percentile | 2 | | |
| 3. Loss of more than 2 kg past 3 months | 2 | | |
| 4. Loss of more than 5 kg past year or signficant decline from growth curve | 4 | | |
| B. Activity | | 10 | |
| 1. Tires easily; unable to work or attend school | 1-6 | | |
| 2. Dyspnea after one flight or at rest | 1-5 | | |
| C. Attitude | | 9 | |
| 1. Follows instructions and/or takes medications unreliably | 1-6 | | |
| 2. Depressed philosophy of cystic fibrosis | 1-3 | | |
| TOTAL GENERAL | | 25 | _____ |
| TOTAL POINTS DEDUCTED | | 100 | _____ |
| FINAL SCORE (100 minus points deducted) | | | |

# MODIFIED NIH SCORE

## NIH CLINICAL SCORING FOR CYSTIC FIBROSIS (REVISED)

NAME_____ DATE OF BIRTH_____ ID#_____
DATE OF RATING_____ RATER_____

| | POINTS | MAX | SCORE |
|---|---|---|---|
| **I. PULMONARY** | | | |
| A. X-ray | | 17 | |
| 1. Minimal accentuation of pulmonary markings | 1-3 | | |
| 2. Increased pulmonary markings; mild overaeration, atelectasis, and/or mucus plugging | 4-6 | | |
| 3. Moderate overaeration, fibrosis, atelectasis, and/or mucus plugging; early cyst formation | 7-10 | | ____ |
| 4. Severe overaeration; extensive fibrosis and cyst formation; pulmonary obstruction, bronchiectasis | 11-13 | | |
| 5. Acute infiltrate | 1-4 | | ____ |
| B. Pulmonary function tests | | 17 | |
| 1. Vital capacity (VC) less than 90% of predicted | 1 | | |
| less than 80% of predicted | 3 | | |
| less than 70% of predicted | 5 | | ____ |
| less than 60% of predicted | 7 | | |
| less than 50% of predicted | 9 | | |
| 2. FEV1 less than 70% of total VC | 1 | | |
| less than 66% of total VC | 2 | | |
| less than 58% of total VC | 4 | | ____ |
| less than 50% of total VC | 6 | | |
| less than 42% of total VC | 8 | | |
| C. Pulmonary exacerbation requiring intensive therapy | | 5 | |
| 1. Past 3 months | 5 | | ____ |
| 2. Past year | 3 | | |
| D. Pneumothorax | | 5 | |
| 1. Past 6 months or recurrent | 5 | | ____ |
| 2. Ever | 3 | | |
| E. Hemoptysis (omit if none since pulmonary surgery) | | 7 | |
| 1. Massive: (a) past 6 months | 7 | | |
| (b) more than 6 mo. ago | 4 | | |
| 2. Small Amount in past year: | | | |
| (a) rare streaks (with acute infection or less than 15 ml | 1 | | ____ |
| (b) occasional streaks or less than 30 ml | 2 | | |
| (c) frequent streaks or greater than 30 ml | 3 | | |
| SUBTOTAL PULMONARY PG.1 | | 51 | ____ |

NAME_____DATE OF RATING_____ID #_____

| | POINTS | MAX | SCORE |
|---|---|---|---|
| I. PULMONARY | | | |
| F. Pulmonary surgery | | 7 | |
| 1. Amount of lung resected: | | | |
| (a) segment | 1 | | |
| (b) lobe | 2 | | |
| (c) right lung 2 lobes | 3 | | |
| (d) right or left lung | 4 | | ____ |
| 2. Length of time since surgery: | | | |
| (a) greater than or equal to 5 years | 1 | | |
| (b) 1 - 5 years | 2 | | |
| (c) 0 - 12 months | 3 | | |
| G. Cor pulmonale (based on symptom state in last 1 month) | | 5 | |
| 1. Asymptomatic | 3 | | |
| 2. Symptomatic-controlled with therapy | 4 | | ____ |
| 3. Symptomatic-intractable despite therapy | 5 | | |
| H. Physical examination (based on last 1 month) | | 9 | |
| 1. Clubbing mild | 1 | | |
| moderate/severe | 2 | | |
| 2. Chest deformity (A-P diameter, rib flare, kyphosis) | | | |
| mild | 1 | | |
| moderate | 2 | | |
| severe | 3 | | |
| 3. Cyanosis present | 4 | | ____ |
| 4. Breath sounds | | | |
| crackles/wheezes-isolated | 1 | | |
| crackles/wheezes-multilobe | 2 | | |
| crackles/wheezes-diffuse with poor airflow | 3 | | |
| I. Sputum production and/or cough (based on last 1 month) | | 3 | |
| 1. Cough alone (Dry cough with CPT or activity) | 1 | | |
| 2. Sputum production (wet cough) with pulmonary exacerbation | 2 | | |
| 3. Chronic sputum production (Chronic cough wet or dry) | 3 | | ____ |
| SUBTOTAL PULMONARY PG.2 | | 24 | ____ |
| SUBTOTAL PULMONARY PG.1 | | *51 | *____ |
| TOTAL PULMONARY | | 75 | ____ |

Page 3 NIH CLINICAL SCORING FOR CF (REVISED)

NAME_____DATE OF RATING_____ID #_____

| | POINTS | MAX | SCORE |
|---|---|---|---|
| **II. GENERAL** | | | |
| A. Weight | | 6 | |
| 1. Poor appetite (in the past 6 months) | | | |
| (a) occasional with pulmonary exacerbation | 1 | | |
| (b) chronic/frequent | 2 | | |
| 2. Less than third percentile | 2 | | |
| 3. Loss of more than 2 kg past 3 months | 2 | | |
| 4. Loss of more than 5 kg past year or significant decline from growth curve | 4 | | |
| B. Activity | | 10 | |
| 1. Energy (in last 1 month) | | | |
| (a) less energetic-tired at end of the day (than same age peers | 1 | | |
| (b) moderate limitation-cannot go through day without rest (needs more rest than peers but continues active play/movement) | 2 | | |
| (c) marked limitation-requires multiple rest periods during the day (restricted to quiet play/rest with little or no active movement) | 3 | | |
| 2. School/work (in past 6 months or last semester) *If not in school/work use # of days not able to participate in daily play, activities, or daycare | | | |
| (a) fair attendance (absence 5-15 days) (below normal motor development) | 1 | | |
| (b) poor attendance (absence greater than 15 days (moderate motor retardation) | 2 | | |
| (c) homebound (marked motor retardation) | 3 | | |
| 3. Exercise tolerance (in last 1 month) | | | |
| (a) slight limitation during strenuous exercise (keeps up or sustains movement usually but slower) | 1 | | |
| (b) tires during exertion, rests voluntarily (in play/movement) | 2 | | |
| (c) limits exercise (movement) due to dyspnea (can't keep up with peers/maintain sustained movement of limbs or head erection) | 3 | | |
| (d) dyspnea with minimal exertion | 4 | | |
| (e) dyspnea at rest | 5 | | |
| SUBTOTAL GENERAL PG 3 | | 16 | |

 **WIN CLINICAL SCORING FOR CF (REVISED)**

NAME_____DATE OF RATING_____ID #_____

| | POINTS | MAX | SCORE |
|---|---|---|---|
| **II. GENERAL** | | | |
| C. Attitude | | 9 | |
| 1. Compliance | | | |
| (a) Clinic Attendance (in past 6 months) | | | |
| (1) partial-forgot or missed follow-up appt.....1 | | | |
| (2) poor-forgot or missed more than 1 appt.....2 | | | |
| (b) Therapy prescribed (in past 1 month) | | | |
| (1) CPT/Resp Therapy | | | |
| partial-irregular (lapses up to 2 weeks)....1 | | | ____ |
| poor-rarely perform (lapses greater than 2 weeks).....2 | | | |
| (2) Medications | | | |
| partial-irregular (missed up to 1 week).....1 | | | |
| poor-(missed greater than 1 week).....2 | | | |
| 2. Depressed philosophy of CF (based on state in last 1 month) (parental state with young children) | | | |
| (a) Feelings of helplessness, depression, loss of control.....1 | | | |
| (b) More severe depressive or loss of control problems with some dysfunction.....2 | | | ____ |
| (c) Disabled functioning due to loss of control, depression, and/or denial.....3 | | | |
| SUBTOTAL GENERAL PG 4 | | 9 | ____ |
| SUBTOTAL GENERAL PG 3 | | +16 | +____ |
| TOTAL GENERAL | | 25 | ____ |

POINTS DEDUCTED PULMONARY ____
GENERAL ____
TOTAL POINTS DEDUCTED ____ MAX=100

FINAL SCORE 100-total points deducted = _____

## APPENDIX XI

DEMOGRAPHIC DATA COLLECTION FORM

## DEMOGRAPHIC DATA COLLECTION FORM

Date ___/___/___

Patient # ___/___/___ Initials ___/___/___

Gender ___M / F___ Age ___years

Hospital adm'n in past year? Y / N ___(# times)

Living arrangements
- ❑ alone
- ❑ with parents
- ❑ with spouse / partner
- ❑ with other people

Student? Y / N FT / PT

Work? Y / N FT / PT

*The following questions (on this page) for adults only:*

Have children? Y / N Number ___

Level of Education
- ❑ less than high school
- ❑ high school diploma
- ❑ technical school / college diploma
- ❑ university degree

Household income level
- ❑ less than $25,000
- ❑ $25,000 to $50,000
- ❑ over $50,000